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ABSTRACT

Individualization of education has been variously defined, from fairly narrow and circumscribed to fairly extensive and comprehensive definitions. The development of a comprehensive procedure for the individualization of education involves consideration of such factors as family/personal, instructional systems, data access, and decision rule factors. In order to be effective, a comprehensive empirically-oriented system for individualized career education must have such attributes as: (1) a cross-indexed set of instructional resources, (2) the identification of the individual student's long-range goals, (3) a bank of data with regard to the individual, his interests, and abilities, (4) a specification of state and local school system requirements, (5) an information system to provide for the confluence of these data, and (6) a set of decision rules whereby educational planning can be effected. Included in this publication are chapters providing: (1) definitions of individualization of education, (2) descriptions of early and contemporary efforts at individualization, and (3) discussions of the attributes of a successful individualized career education program. (SB)

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INDIVIDUALIZATION OF EDUCATION
IN
CAREER EDUCATION

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FINAL REPORT

INDIVIDUALIZATION OF EDUCATION
IN
CAREER EDUCATION

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June 1972

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PART I* - INTRODUCTION TO INDIVIDUALIZED EDUCATION

CHAPTER 1

INDIVIDUALIZATION DEFINED

Individualization has long been a goal of American education. Washburne, in the 24th National Society for the Study of Education Yearbook entitled Adapting the Schools to Individual Differences, has written: "It has become palpably absurd to expect to achieve uniform results from uniform assignments made to a class of widely differing individuals. Throughout the educational world, there has therefore awakened a desire to find some way of adapting the schools to the differing individuals who attend them" (1925, page 79). Similarly Reavis has argued, "Under the old regime in the effort to give different children the same subject matter in the same length of time, the quality of the children's work, the degree of their mastery, varied from poor to excellent, as attested by their report cards. But under the new technique of individual education, instead of quality varying, time varies: a child may take as much time as he needs to master a unit of work, but master it he must" (1925, page 49). While these words have a contemporary ring to them, they were written almost half a century ago.

Individualized education does not mean isolated learning, independent learning, machine-managed learning, or commitment to any particular methodology. It means simply that the education an individual is to receive is carefully considered before the fact and tailored, to the extent possible, to accommodate that particular student's interests, abilities, needs, and learning styles. Individualized learning does not imply the lack of group learning, peer-group interaction, social involvement with classmates, etc. Individualized education does imply, however, a radical departure from the often implicit, albeit necessary, philosophy of instruction which subordinates the individual to the group for convenience of administration, classroom logistics, and efficiency of information presentation.

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If a learner is to receive large-group instruction, it should be because that method of instruction is optimum for him, not because it is simply the most expedient method of instruction, administratively the simplest, or administratively the most convenient. Individualized education requires that the major commitment of the educational system be to what is most desirable for the individual rather than toward what is most convenient for the educational manager.

In spite of an avowed interest in, and concern for, children as individuals, the basic organizational pattern of schools typically reflects a concern for groups of children rather than individual children. This may simply be a matter of administrative expedience. Schools, in order to be conscientious regarding the expenditure of public funds, must be concerned with questions of efficiency in supply and logistics, pupil supervision, utilization of limited and/or high cost resources, and the like. Thus they tend to adopt a grouping expedient. One very real problem faced by education is how to preclude this group oriented structure from interfering with the treatment of children as individual human beings with unique patterns of developed abilities and educational needs. Or, to put it more bluntly, the problem confronting education today is how to so organize itself so that the necessary administrative bureaucracy of the system does not impede the fulfillment of its humanistic goals.

Education has no doubt wrestled with this problem since it began to emerge as a formalized social institution. History clearly indicates a long-standing social awareness of individual differences. Socrates was concerned with individual differences (most of his teaching was in the form of tutorial dialog) and the Roman Quintilian stressed the importance of learner participation and self-direction in educational matters, and Comenius, in the 17th century, argued that instruction needed to be adapted to the capacity of each student (Stecchini, 1964).

Individualization has been defined as "the adaptation of instructional practices to individual requirements" (Cooley and Glaser, 1969), "the use of information about individual differences to prescribe appropriate educational environments" (Bolvin and Glaser, 1968), and "planning and conducting, with each student, general programs of study and day to day lessons that are tailor made to suit his learning needs and characteristics as a learner" (Heathers, 1968).

The terms individualized instruction and individualized education are often used interchangeably in the literature. Indeed, the term individualized education is often applied to instructional programs where little in the program is individualized save the rate at which the learner progresses through the materials. Technically a distinction can be made between individualized instruction and individualized education (Flanagan, 1971).

Individualized instruction is more appropriately used to refer to those programs where instructional technique and methodology is varied. Individualized education, on the other hand, is more appropriately used to refer to those programs where not only the instructional method, and materials are varied, but also the curriculum itself, i.e. the academic content to be mastered, is varied. While the foregoing may seem a relatively obvious distinction, it is one that is frequently not recognized.

The individualization of instruction, then, involves the consideration of only one question; namely, how can the student best learn what he is expected to learn. The individualization of education involves an intensive consideration of two questions: What is the student to learn? and, How can he best learn it?

What a person is to learn is a function of: the overall goals of the school system; the total domain of learning experiences available to the student through the system; what the student already knows; what he, his parents, and society would like for him to know; and, finally, his ability to learn.

How a student can best learn that which has been identified for him to learn depends on: the rate at which the student can assimilate the material;

the organization, structure, and sequence of the material that has been selected; the sensory modalities of presentation that are optimum for him; the difficulty level of the material to be learned; the nature of the physical and social context in which the teaching/learning takes place; the amount of teacher supervision, assistance and support available; the type and level of performance desired; and the desired length of skill retention.

Individualized education, to be implemented to its fullest, would involve the entire instructional system, its organization, personnel, and materials.

Needless to say, developments in the last two decades, in the area of better understanding human behavior and also in the increased availability of highly sophisticated instructional materials and hardware, make it more possible than ever before to individualize education without the expenditure of large sums of money in one to one (tutorial) instructional arrangements. Programmed instruction, computer-assisted instruction, flexible scheduling, modular grouping, ungraded classrooms, team teaching, differentiated teaching staffs, open school arrangements, guaranteed performance contracting, criterion-referenced progress monitoring, and the like all offer some leverage toward the achievement of individualization. Taken separately, however, none of these can fully individualize education.

CHAPTER 2

EARLY EFFORTS AT INDIVIDUALIZING EDUCATION

Research on individual differences has probably had a broader impact on curriculum and curriculum development than any other development in psychology (Kearney and Cook, 1958). With the gradual introduction of compulsory school attendance laws in the 19th century, increasing numbers of children were required to remain in school for longer periods of time. As a consequence major administrative accommodations were required. One result was the rise of the graded school system in which students were grouped together either on the basis of age, or on level of academic achievement. By 1860 nearly all city schools in the United States were graded (Goodlad, 1958). Thus did American education begin to provide administratively for variance in individual differences.

The growth of the secondary school system with its departmentalized curriculum and options for multiple curricular tracking offered yet another alternative for individualization. Indeed the tracking/course electives model stems primarily from the work of the National Education Association curriculum "Committee of Ten."

The Committee of Ten (1893) wrestled with the problem of how best to implement an individualized secondary school program. Their solution was very simple; and, with only slight modification in 1918, it set the mode of secondary education for almost half a century (Sizer, 1964). In essence, the recommendations called for the establishment, and standardization, of a set of core courses which would comprise the educational base of all students. Collateral with these basic requirements would be an array of "elective" courses which could then be selected by the student on the basis of his interest. This paradigm still has clear contemporary relevance and remains the standard educational pattern being practiced today, at the college level as well as on the secondary school level. Later elaborations of the paradigm involved the identification of various alternative "tracks" such as vocational, business, general, and college preparatory. The Committee did not address the basic question of the content of the courses, however, a problem to recur repeatedly throughout educational history.

Differential Grouping,
Differentiated Teaching

The earliest efforts at the individualization of education, then, tended to cluster around what might be called differential grouping models. The objective of differential grouping was to reduce the range of requisite teacher performance by attenuating the range of individual differences in the group he/she was to instruct. In the earliest manifestation of this strategy students were typically grouped together on the basis of age, ability, some common curricular track, or the like.

Eventually alternative methods were also developed to pursue this same goal. If the goal was to minimize the range of requisite teacher skills, the same objective could be achieved by reducing the range of responsibility of any given teacher, and increasing the number of teachers responsible for the instruction of the group. This alternative, in earlier days, took the form of the platoon system where teachers had different subject matter specialties and the modified platoon system, or the core program, where a single teacher had responsibility for the basic academics of classroom instruction but where she was supported by a variety of teacher specialists in such areas as spelling, music, penmanship, physical education, and the like.

In the last decade or so newer versions of these two strategies have appeared on the side of further differentiating teacher responsibilities, schools have been experimenting with team teaching, and differentiated staffing patterns, master teachers, teacher aides and the like. On the side of further reducing group variance schools have experimented in carrying this to the extreme by reducing the group to a size of one through the use of person to person tutoring, such as peer tutoring, or the use of individual student response systems such as the EDEC system, the RESYC system, language laboratories, and Dial Access. These latter types of efforts are discussed in the following section.

Individual Student Response Systems

In this approach the teacher uses various forms of instructional technology to register and react to individual student responses on an individual basis. One of the most sophisticated forms of this technique is the EDEC system where each student has a response panel at his desk on which he can register his answers to teacher questions and oral tests. Typically, intermittantly during discussions the teacher will ask questions which have multiple choice answers and the student can register his responses by pushing an appropriate button on his response panel. His response is automatically tallied by the monitor console on the teacher's desk so she can see immediately the responses of all students in the class. If the results suggest the class does not understand the point the teacher has been trying to make she can continue to elaborate on it.

In sophisticated EDEC versions, running totals are kept for each student so the teacher can identify those students who may need special assistance.

This procedure allows the teacher to conduct the class in an essentially tutorial mode even though she is addressing the class as a group.

A similar approach is in the language laboratory where students study independently in small study carrels. In the typical language laboratory the student in his cubicle recites into a microphone and tries to match his pronunciation with a recorded standard that he hears through headphones. The instructor can monitor each cubicle in turn and can engage in tutorial dialog with each student on some time sampling basis.

A third form of the individual student approach is the Dial Access system. Dial Access is a generic term referring to the capability of a student to selectively call for specific instruction any time he chooses. Typically the instruction is from audio tape recordings, but in more sophisticated systems the audio input may be coordinated with film loops and other forms of multi-media presentation.

In its simplest form the student goes to a study carrel, often in a library, when he is ready to study a particular subject. He puts on a set of earphones and activates the audio tape by dialing the appropriate lesson call number on a dial similar to a telephone dial. He can then listen to the tape recording of the lesson. The tape recording may also be keyed to a slide projector or film loop projector or video tape recorder so that the student may receive visual presentation as well as audio presentation. When the student is through with the lesson he simply hangs up and leaves.

The advantage of this system is that the student can review the instruction as frequently as he likes, and can study the lesson at his convenience. The Dial Access lesson may also be coordinated with assigned readings, study guides, etc.

The first example of the use of audio recordings for the instruction of foreign language was in 1904. As early as 1924 students at the Ohio State University were studying Spanish using the learning laboratory approach (Hocking, 1967). The first Dial Access system which made it possible for students automatically to select individual tape recordings at will was installed at the University of Michigan in 1961 (Ofiesh, 1968). The Michigan Laboratory permitted students to access any one of 108 separate audio channels by dialing specific code numbers.

By 1965 broad purpose multi-media Dial Access installations were beginning to appear at a variety of colleges, among them Ohio State University, Oklahoma Christian College, Grand Valley State College (Ofiesh, 1968). By 1970 approximately 200 such installations were in operation across the country. Approximately half were at the college or university level, and half at the public school level.

The Ohio State Dial Access system, which is limited only to audio playback, is accessed between 35 and 40 thousand times each week.

One of the most elaborate Dial Access systems is one installed at the Grand Valley State College near Grand Rapids, Michigan. That system has over

250 individual study carrels housed in the university library. About half of the carrels have access to eight closed circuit television channels as well as 120 audio channels (Wisniewski, 1967). The audio components are used for instruction in such subjects as language arts, music, public speaking, and speech therapy. The audio plus television capability is used in instruction in such courses as physics, anthropology, political science, psychology, and teacher training.

Yet another approach to meeting individual differences was the progressive educational movement.

Progressive Education Formats

Progressive Education Association. Progressive education may be considered to have its antecedents in the Sophist movement in early Greece. Progressive education is child- or learner-centered and often learner-directed.

Progressive education in the 20th century had its origin in the laboratory school established by John Dewey in 1896. Saettler (1968) has described Dewey's classroom as containing "none of the conventional arrangements, routines, or activities" but where some "children might be busily engaged with books; others with pen and paper; and some might be painting or using hammers. The teacher could usually be found mingling with the children, offering guidance and counseling as the children proceeded with their activities." The "project approach" where the children worked cooperatively on some project meaningful to their experiential background was common practice.

The years following Dewey, supported by the growing body of knowledge of child growth and development, saw increasing reliance on the learner to self-select the material he was to learn and the activities he wished to engage in to master that material (see for example Olson, 1959). Considerable evidence was accumulated to suggest that allowing students to determine what, when, and how they would learn did not result in their being less well educated.

Indeed there was strong evidence that students educated under the progressive education paradigm were even more successful in college than their more traditionally trained counterparts.

One of the major studies in the area was The Eight Year Study of the Commission on the Relation of School and College of the Progressive Education Association. It was an eight year longitudinal study, begun in the fall of 1933, and conducted in cooperation with 300 colleges and universities. The cooperating colleges and universities agreed to accept students from 30 experimental schools regardless of the course of study they followed and regardless of the types of academic credit they submitted for admission.

One thousand four hundred seventy-five graduates were matched with counterparts receiving more conventional educations. The results were that graduates of the experimental school programs had higher scholastic records in all areas, with the exception of foreign languages. They earned more non-academic honors and "more often demonstrated resourcefulness in new situations" (Aikin, 1942).

From the point of view of association membership, the progressive education movement was never very large in the United States. It voted itself out of existence in 1955. It did serve, nevertheless, as a major influence in the shaping of psychological research and in the challenge of traditional concepts of curricular requirement.

Many factors worked against the progressive education movement. The problems of the Depression and then the Second World War fostered an urgency and no nonsense attitude toward education. And then after only brief respite in the post-war years, the launching of the Russian Sputnik again reaffirmed in the public's mind, the urgency of mastering academic skills as quickly as possible.

The successors to the tradition of child oriented educational programs, if not deriving directly from Dewey, at least from the same general philosophical position, are Summerhill, the British Open School or Open Classroom movement, the Free Universities, and the Alternative Schools movement.

Summerhill. Summerhill is a small residential school founded in 1921 in Suffolk, England. It normally has approximately 50 students ranging in age from five to fifteen. The school was founded on the principle of group self-determination. The students and adults form a relatively closed community in which all members are voting members and the community is bound by the decisions of the group. In this regard Summerhill even outstrips the progressive education movement in its degree of child centeredness. Indeed Erich Fromm has described progressive education as being debased because in progressive education in spite of its professed liberality the child is still "forced to swallow the (educational) pill" even though it has been given a sugar coating (Neill, 1960).

The Open Classroom. The English Open Classroom concept is a by-product of the mass evacuation of English children from the cities to the rural countryside during the Blitz. Local educational facilities were not adequate to accommodate the large influx of new children, consequently, instruction had to be carried out in whatever space was available. Typically there were insufficient textbooks and traditional instructional materials to accommodate the children, consequently, instruction had to be predicated on whatever materials were available. Thus, children were often taught out-of-doors, in homes and workshops using common objects such as carpenter's tools, kitchen measuring cups, old magazines and the like.

The results of such an approach generally met with favor, from parents as well as students, and the movement eventually grew to national proportions. Its impact is currently being felt in this country, in large measure due to Silberman's book *Crisis in the Classroom* (1970).

Silberman is an author and editor who spent three years, under a grant from the Carnegie Foundation, visiting schools throughout this country. Silberman concluded that the schools, for the most part, were traditional, authority oriented, stultifying, and not at all reactive to the real needs of students. He did point to a number of exemplary school experiments across the country, however, which appeared to be successful in meeting children's needs, stimulating their intellectual curiosity, and generally maintaining a high regard for the student as an individual in his own right.

The Free Universities and Alternative Schools. The Free University movement and the Alternative Schools movement were grass roots efforts to reassert individual oriented, self-determined educational efforts. As such they may be viewed as a reaction to the curriculum centered efforts which were in the ascendancy in the 1950's and 1960's.

The Alternative Schools movement was, in essence, as effort on the part of parents to create new forms of instructional experience in lieu of the traditional public school program. These were often established independently of the public school structure but more recently, as in the case of the Oakland California school system, are being operated under the auspices of the public system with funding either from the school system itself or from federal funds via the school system.

Whereas the Alternative Schools movement and the Free University movement are both grass roots reactions to the more formal educational establishment, there is typically little similarity between the two. The Alternative Schools movement is included here because it represents an effort to revitalize the curriculum of the system to make the content being taught more relevant to the needs of its students, who are often minority students. In that regard it is in the progressive tradition. The instructional methodology employed in such schools may or may not be in that tradition, however. Indeed, some times it is even more "conservative and traditional" than that of the local school system.

By the late 1960's spontaneous movements across the country, usually at or near major universities, could be seen. These generally took the form of a loose knit group of students, faculty, and community peoples bonding together to provide mutual self education in areas of common interest. In the better organized efforts such as the Mid-Peninsula Free University a formal catalogue of courses was produced each year offering several hundred "courses" ranging from weekend instruction in bay and ocean sailing to the flora and fauna of the High Sierras, from sandal and candle making to the principles of stock market investment, from sensitivity training and Zen Buddhism to the psychology of minority groups and social action.

The common elements of the Free University movement tended to be 1) a strong interest in student learning; 2) a strong antithesis for rules, regulations and regimentation; and 3) a commitment to the principle of "do your own thing," i.e. self selection.

Structured Curriculum Models

In contrast to the differentiated grouping efforts where students were segregated into homogeneous groups, tracked into particular curriculum sequences, taught via a platoon arrangement, or some other such procedure, and in contrast to progressive education efforts concerned with self selection and/or group project methods, other efforts tend to be based on the assumption that if a curriculum is properly developed, sequenced, and managed all students will meet success, albeit perhaps at different rates of progress. All that was presumably necessary was a curricular structure which would permit independent student progress irrespective of the level of development of the other students with whom he was associated (some of these early efforts were also called progressive education but more because of their classroom character of freedom rather than their curricular freedom).

Montessori. An early effort in this direction is represented by the work of Maria Montessori (1912). Montessori was a young medical student in Rome during the early years of the 20th century who became interested in the problems of educating underprivileged children in the tenement slums of the San Lorenzo District.

In 1909, she published her Scientific Pedagogy as Applied to Child Education in the Children's Houses. By 1913 her reputation had risen to considerable heights in the United States; however, within only a matter of two or three years, her work passed from professional interest. Perhaps because, as McV. Hunt (1964) explains, her methods and philosophy were not compatible with the dominant psychological theories of the times.

Because Montessori advocated a child-centered approach and permitted great motoric freedom in her classes, she is sometimes considered a progressivist. She made extensive use, however, of a highly defined set of "didactic materials" integrated into a rather formal curriculum. Interestingly enough, although Montessori's inclination was basically clinical, her instructional curriculum made use of what today would be called behavioral objectives. Examples of some of her objectives are "recognition of musical notes by the help of a series of duplicate bells," "to rise and be seated in silence," and "association of the graphic sign (numeral) with the quantity."

Burk. Another early effort at the systematic development of instructional materials that could be used independently by students is that of Burk. Frederick Burk was the president of San Francisco State Normal School (later to become San Francisco State University). In 1912, Burk, in cooperation with faculty members of the Normal School, began to address the problem of the individualization of instruction, first in the area of mathematics and subsequently in other areas. In connection with the supervision of student teaching, Normal School staff and students developed "self-instruction bulletins" for the classes they taught. The materials were prepared, mimeographed, and tried on the child in the Normal School's associated laboratory school. These self-instructional materials were accumulated and soon comprised entire courses.

In the first class in which it was tried, a mathematics class, at the end of the year the slowest student had successfully completed a year's arithmetic. The fastest student had completed two years of work. All of the basic academic instruction at the laboratory school was eventually predicated on these self-instructional materials.

The self-instructional bulletins were described as self-instructional materials, assignments, and explanations written in such simple language that the child could, for the most part, teach himself. The teacher, of course, was always available to help the student when needed, but the materials were written as though no other help were available. These materials were written using existing textbooks but assigning specific lessons, amplifying and clarifying certain explanations, and adding special supplementary materials and exercises.

In a description of his effort Burk wrote:

> The class system has been modeled upon the military system. It is constructed upon the assumption that a group of minds can be marshalled and controlled in growth in exactly the same manner that a military officer marshalls and directs the bodily movements of a company of soldiers . . . the class system does permanent violence to all types of pupils. It does injury to the rapid and quick thinking pupils because these must shackle their stride to keep pace with the rate of the mythical average. They do so usually at the price of interest in their work. Their energy is directed into illegitimate activities with the result that in the intermediate grades a large portion of them fall into the class of uninterested, inattentive, rebellious, and unmanageable pupils.
>
> The class system does a greater injury to the large number who make progress slower than the rate of the mythical average pupil. Necessarily they are carried off their feet by the momentum of the mass . . . by setting the pace of a mathematical average, education for nearly one half of the class is made impossible. They are foredoomed before they begin. (Burk, 1935).

It remained for Washburne to give many of Burk's ideas their major tryout. Washburne taught in the San Francisco Normal School under Burk from 1914 to 1919 when he became superintendent of the Winnetka Public Schools. While at San Francisco State Normal, Washburne wanted to restructure the science curriculum to make it more relevant to the interests and needs of the youth studying it. Washburne asked himself what were the "common phenomena of every day life requiring a knowledge of science if they are to be understood? And what are the questions of the children ages nine to fourteen they are most eager to have answered?" (Washburne and Marland, 1963, page 15).

To answer his first question Washburne observed and recorded as many common experiences of children as possible, i.e., the things children do and wonder about, such as why a kite flies? why a balloon rises? why a towel absorbs moisture? why soap removes dirt? etc. He then, in cooperation with his college students, began to devote class time to answering any question a child wanted to ask. These questions were recorded as they were answered. It was from this fairly extensive survey of children's interests, and children's experiences, that he developed his science curriculum so that it provided answers of interest to children.

Winnetka. On assuming the superintendency of Winnetka, Washburne was in a position to apply the philosophy of Burk to an entire school system for over a quarter of a century. In brief, the procedure involved the development of: 1) self-instructional assignments and workbooks, 2) diagnostic tests to assess what children can do, and where they needed help, and 3) performance tests to assess students' mastery of what they had recently studied.

Washburne identified the ages at which material offered would be most likely mastered by students and sequenced the curriculum accordingly. Similar efforts were made to identify the age groups to whom various types of books, experiments, etc. would be most interesting.

Once the instructional system was organized to a sufficient extent that a good deal of the formal academic instruction could be accommodated by independent self-study, the teacher had more time to attend to the development of creative experiences in the form of projects, field trips, classroom enterprises and the like.

Winnetka eventually came to have a public nursery school attached to the schools and their own teacher-training programs for first year teachers and for graduate study.

In describing the Winnetka plan, Klaus (1969) wrote:

> Emphasis was placed on anticipating learning difficulties and on personalizing the lesson materials. The exercises were scored and corrected by the children themselves using the answers provided at the end of each lesson. Promotion from one grade to the next depended solely on the progress evidenced by each student on the unit test given every six weeks . . . the children were assigned the instructional material modules in sequence. Although rate was allowed to vary, every child was expected to follow approximately the same program (page 46).

Evaluation of the Winnetka plan generally suggested significant student gains over more traditional methods.

The Dalton and Morrison Plans. At the same time that Washburne was developing the Winnetka program, Helen Parkhurst developed the Dalton Laboratory Plan and Morrison the Morrison Plan.

The usual features of the laboratory school approach were "a) The student is free from recitation and other class routines of the common type. b) The classroom ceases to be a recitation and lecture room and becomes a laboratory work room. c) The curriculum is divided into the minimum essentials and social and creative activities. d) The minimum essentials are then subdivided into their component parts for instruction. e) Elaborate materials are used, including diagnostic tests, achievement tests, study guides, practice materials, and record forms. f) Each student is permitted to proceed through the work as rapidly as his abilities and levels of motivation permit. g) The role of the teacher is that of giving help and guidance to their students" (Wingo, 1957). It is interesting to compare this effort of almost 50 years ago to PLAN and Individually Prescribed Instruction systems to be described presently.

The problems associated with such programs as the Winnetka, Dalton and Morrison Plans usually revolved around such issues as the rapid obsolescence of materials, difficulties associated with supply and logistics and the large quantities of materials needed, the overpowering press of clerical tasks associated with maintaining materials, scoring tests, correcting papers, recording student progress and the like. These difficulties by no means seem insurmountable. However, in spite of the ambitious and creative efforts of the Winnetka and Dalton Plans, the bulk of the public schools in the United States still attempt to accommodate for individual differences primarily through such mechanisms as homogenous grouping, multiple track curriculums, special class placements for the exceptional child, and differentiated staffing.

The Instructional Objectives Approach. In contrast to the full scale laboratory school approach, the instructional objectives movement presents an alternative approach to the detailed specification of educational experiences for children. Although the approach is different, the goal is exactly the same. The objective of both efforts is to so organize, specify, and sequence the instructional program of the child that student achievement will be all but assured.

The terms instructional objectives, educational objectives, curriculum objectives, and behavioral objectives, are often used more or less interchangeably. Many authors find it useful to consider objectives along a continuum of specificity with objectives at various levels of specificity being given different names. For example, educational objectives might be used to refer to the fairly broad scope objectives characteristic of education in general; curriculum objectives may be somewhat more specific; instructional objectives even more specific; and behavioral objectives at the highly specific "nitty-gritty" level. This nomenclature is by no means standard however. In general, though, the term most clearly understood is that of behavioral objective and as indicated earlier in the text, this means an objective stated in behavioral terms.

The instructional objectives movement characteristic of the 1970's is the result of the convergence of two separate efforts. One derives from the early work of Franklin Bobbitt in 1918, and eventuates in the educational assessment work of Tyler (1950) and Bloom (1954). The second derives from work in human factors, man machine systems, military training programs, and programmed instruction (Gagne and Bolles, 1959; Briggs, 1959; Miller, 1953; Skinner, 1958; Stolurow, 1961; Mager, 1961; and others).

Curriculum developers have long been concerned with the statement of broad educational goals or objectives. These are often couched in extremely broad terms such as "develop the foundations for economic self-sufficiency," "develop intellectual curiosity " and "a desire to learn," "develop the child to his maximum potential." An excellent contemporary statement of such broad educational aspirations is New Directions for the American School by the Committee on Economic Development (1968).

Franklin Bobbitt is generally considered the father of contemporary curriculum theory. As early as 1918 he advocated a detailed specification of the school's educational curriculum in terms of specific objectives. In essence, Bobbitt, almost over a half century ago, called for what is today termed a task analysis. He advocated that "one go out into the world of affairs and discover the particulars of which these affairs consist. These will show the abilities, habits, appreciations, and forms of knowledge which men need. These will be the objectives of the curriculum." (Bobbitt, 1918).

Bobbitt's approach was to study life carefully, identify the requisite skills required for success in life, divide those skills into specific units, organize those units into educational experiences and provide those experiences to children. Some years later in his book How to Make a Curriculum, Bobbitt listed 160 educational objectives. An example of one of these objectives was "ability to entertain one's friends."

Following Bobbitt's lead, and stimulated by the work of Thorndike which suggested that transfer of learning was limited to only highly similar situations, curriculum theorists began to analyze various academic areas extensively. Pendleton listed 1,581 objectives for English, Giller listed more than 300 objectives for elementary school arithmetic and Billings specified 888 objectives for social studies (Eisner, 1967).

This movement quickly collapsed under its own weight, however, because of the sheer impossibility for teachers to manage the literally hundreds of educational objectives without specially developed instructional materials, assessment procedures, and a great deal of clerical assistance. In addition, both the disaffection of educators with early behaviorism and the growth of the child development movement, resulted in the abandonment of critical skills identification and instructional objectives development. The tradition was maintained, however, in the field of educational measurement and evaluation.

Ralph W. Tyler was one of the more articulate spokesmen for educational evaluation in the 1930's and 1940's. The problem of educational evaluation is, of course, that it is necessary to know precisely what it is the school system is trying to accomplish before one can assess whether or not it has in fact been accomplished. Thus, the statement of objectives becomes essential for curriculum evaluation. Furthermore, the objectives must be stated sufficiently well that independent readers will manifest a high degree of agreement as to the precise meaning of the objectives.

Concern with the objectives of instruction for assessment purposes became of paramount importance to the College and University Examiners of the University of Chicago during the post-war years. A committee of the College and University Examiners undertook the development of a taxonomy of educational objectives to serve as the foundation for their assessment activities. This resulted in the publication of a Taxonomy of Educational Objectives in 1956 by Bloom, Engelhart, Furst, Hill, and Krathwohl.

At approximately this time the instructional objectives movement received considerable impetus from work being carried out in human factors research, military training, and programmed instruction (see Gagne, 1965, for example). The specification of behavioral outcomes, i.e. terminal behaviors, was considered an essential characteristic of the systematic development of technical training programs and programmed learning. In other words, the instructor or the trainer had to know precisely what it was he wished his students to be able to do as a consequence of the training program. Skinner (1958) indicated that an essential first step in the design of programmed instruction was the specification of the objectives the program was intended to accomplish. Whereas there is often disagreement among applied human learning theorists as to methods of instructional management, factors associated with human learning, and the like, there is, for the most part, considerable agreement as to the importance of precisely defined a priori specification of desired terminal behaviors.

Given the importance of instructional objectives, what then constitutes the characteristics of good instructional objectives? Miller, who has probably written more than any other person on the topic of task analysis has described a good behavioral objective as having: an indicator, an action word, a control word and an indication of response adequacy. For example, according to Miller, a good behavioral objective would be: when the alarm clock rings, push the alarm button in until a click is heard. The indicator is the signal for the beginning of the individual's action. In this case it is the ringing of the alarm clock bell. The action is to push something in. The control is the alarm button on the alarm clock and the indication of response adequacy is the click that the alarm button makes when it is fully depressed. Of course, the same behavioral objective could be worded in other ways. The indication of response adequacy could be stated as the termination of the alarm bell, not the click of the switch button.

The appearance of a book by Mager, Preparing Objectives for Programmed Instruction (1961), did much to communicate the essential qualities of good objectives specification to the educational field.

An objective, in order to be entertained as an important objective, must be explicit and it must deal with a behavior considered essential for some long range goal.

Objectivity in the statement of an objective is usually predicated on expression in behavioral terms, that is, in terms of overt actions about which independent observers would tend to agree. The key here, however, is not so much the fact that motoric behavior is involved as much as that there is a high degree of reliability in the judgments of independent observers. An interesting study by Deno and Jenkins (1969) pointed out that many of the words used in writing behavioral objectives did not refer to highly detailed actions but rather had relatively high reliability as to meaning. Deno and Jenkins conclude that "perhaps behaviorally inclined curriculum developers have become sensitive to the criticism of trivialness in the objectives which they have written and have fallen prey to using only the moderately reliable terms . . ." "Rather than write objectives containing only the verbs to underline, to cross out, to write, to say, they have opted for what might be called process words such as identify, solve, recognize, distinguish, apply . . ." (page 23). Interestingly these terms are proposed by Metfessel, Michael, and Kirsner (1969) in their article "Instrumentation of Bloom's and Krathwohl's Taxonomies for the Writing of Educational Objectives."

In describing the statement of objectives and the degree of explicitness appropriate for objectives, Klaus (1969) has indicated "at first instructional objectives were prepared in the form of a statement. Many educators suggested preparing objectives this way (see Lindvall, 1964) and this format was used by Bloom and his associates." Later on objective writers in their quest for behaviorality attempted to express objectives in the form of test items or statements about performance on test items. As experience accrued with the statement of instructional objectives there was a tendency to make objectives broader in scope and differentiate the broader terminal objective in terms of the interim objectives. The procedure which came to be adopted was to specify the ultimate outcome of instruction and then work backwards in the specification of the subordinate "enabling objectives" necessary for the achievement of the ultimate objective (see Taber, Glaser and Schaefer, 1965).

The reasons for the specification of objectives are several. First, the instructional designer must know what it is he is attempting to accomplish. Second, in order to evaluate the effectiveness of the training program, and/or in order to ascertain when the learner should transition to new activities, it is essential to be able to assess whether or not the learner has in fact achieved his goals. Third, precise definitions of the terminal behavior desired permits identification of the requisite component behaviors, i.e., those "enabling" foundational behaviors necessary for the achievement of the complex performance. And fourth, providing the learner with information as to precisely what it is he is supposed to be able to accomplish after the training program presumably would facilitate the acquisition of skills. For example, if the learner knows he must be able to discriminate among ten printed foreign words when instruction has been completed, this has certain implications for the learner's focus of attention. He is not going to be concerned with pronunciation.

In regard to this last point, Mager and McCann (1961) investigated the relative effects of providing learners with explicit statements of the objectives they were to master during the course of their training program. Groups of engineers were trained on a number of different tasks pertaining to their jobs. One group was a traditional instruction group in which the instructor controlled the sequence and rate of content presentation. A second group was an independent study group in which the students were permitted to sequence the content in any order they wished, and to study any content in as much depth as they wished. In the third group the students were given detailed statements of the training objectives and then allowed to study the content as they wished. Thus, the only difference between the second and third groups was that the third group knew the specific objectives of the training program whereas the second group only knew the overall goal of the training program. The results of the study showed that the time required for training group three was reduced 65% over traditional training methods, without loss of proficiency. Other studies of the effectiveness of providing the learner with instructional objectives prior to instruction are equivocal, however.

While there may be some question as to the relative merits, in some situations, of providing students with knowledge of the specific objectives they are to master, there is general agreement that it is probably helpful in many instances. Without a doubt, however, it is essential from an instructional systems development point of view, and also from an assessment point of view. Indeed, it is this latter point that has resulted in the recent shift from an almost total reliance on norm group referencing, a tradition of long standing duration in education, to a criterion referenced posture.

Criterion referenced assessment is the foundation on which recent trends in educational innovation have been based. The National Assessment of Progress in Education, for example, is an attempt to assess what children and adults actually know and can do in the areas of reading, citizenship, and the like rather than simply where they stand in comparison with their peer group. Criterion referenced assessment was also the foundation for some of the recent effort of the federal government in guaranteed performance contracting, and "accountability."

Programmed Instruction. Programmed instruction was originally introduced to education not so much as a device for individualizing education but rather as a device for maximizing student learning. Nevertheless, because it was "instructor free" it was quickly adopted as a method for allowing individual self pacing.

Programmed instruction was in large measure an out-growth of the operant conditioning work of B. F. Skinner. Skinner turned his attention to applied human learning after World War II. One of his early theoretical papers in the area was The Science of Learning and the Art of Teaching (1954). In this paper Skinner suggested that inexpensive machines might be developed which could manage the instructional activities for students far more effectively and efficiently than teachers. Although Pressey many years earlier (1926) developed a multiple response testing machine, and used it as a student drill and practice device, it remained for Skinner to test out the concept of machine monitored instruction. This was done in the Introductory Psychology course at Harvard University. The content of the course was programmed and administered to the student by way of simple "teaching machines." Programmed instruction at that time consisted of a series of "frames" which were small sentences or questions which appeared very much like test items on an objective test. By sequencing these in linear fashion, building one upon the other, the student eventually came to master the material represented in those items.

Early programmed instruction was based on the notions of linear progress, taking small steps one at a time, requiring active student participation, and providing the student with immediate knowledge of his results which, it was felt, would serve as a reinforcement to the student. This mode of instruction appeared reasonably successful. Very shortly, however, a major theoretical embellishment was added. Rather than linear programming in which all students went through exactly the same series of steps, Crowder (1961) advocated including subroutines in the program to allow the student to "branch" based on his recent performance in the program. For example, if the student were having difficulty and missed several items in a row he would be branched out of the main program, referred to a remedial study section, or subprogram, for review and then returned to the main linear program. By imbedding a series of such recycling loops,and for the very bright student accelerating loops, it was possible to accommodate large degrees of individual differences in student background and learning ability.

Early in the work of the programmed instruction movement several developments began to take place. Many of the initial applications of programmed instruction were in highly controlled academic learning sessions. Other investigators, however, were concerned with the application of operant techniques in natural settings. Ogden Lindsey, for example, was concerned with shaping the behavior of mental patients to more normal patterns through operant techniques. Bear, Bijou and others in Seattle at the University of Washington were concerned with naturalistic classroom settings. Charles Struthers experimented with the use of operant conditioning techniques in nursery schools and in classes for retarded, brain damaged and emotionally disturbed children. His techniques involved providing the teacher with a small radio receiver, similar to a hearing aid, which the teacher could wear while in the classroom. Psychologist observers were then stationed behind one way vision screens to observe the classroom behavior of specified children. The psychologists could speak to the teacher via her hearing aid and give her special instructions.

As a result the teacher had "eyes in the back of her head," and could be kept constantly aware of the performance of these specified children so that she could immediately administer reinforcement for the particular behaviors the psychologists were interested in maximizing. This was especially useful in shaping the behavior of hyperactive children in the classroom.

The main thrust of programmed instruction, however, continued to be in the more traditional academic applications. An early controversy in the field revolved around the necessity for machine mediation. The early concepts of programmed instruction held that the machine was essential to monitor the progress of the child, to enforce active participation, and to preclude "cheating" on the program. There were, of course, compromises which had to be made with regard to the degree of machine control that could be exerted on the student's performance. On the one hand were those machines which were highly sophisticated and which were virtually cheat proof. An example of one such machine is the Mark II Auto Tutor which had a large screen similar to a television screen. The instructional material was projected on the screen from microfilm. The machine had sophisticated branching capabilities, and it was impossible to proceed from one frame to the next without executing the correct performance. On the other hand, inexpensive machines selling for only a few dollars which did little more than provide a moving window for scanning a printed page were used. Today a machine is no longer regarded as essential for any but highly specialized purposes.

Because of the awkwardness of machines, much of the programmed instruction movement shifted to what is referred to as scrambled books. No doubt a heavy consideration in this movement was also simple market considerations. Publishers were used to textbook publication, the paperback book was easy to produce and sell, the cost was right, and some studies suggested that the use of scrambled books resulted in performance equally as good as that obtained with expensive machines. Regardless of what factors played a role in the movement of the program instruction enterprise to scrambled books, it is sufficient to say that scrambled books quickly formed the backbone of the programmed instruction movement. One of the very early successes in this area was English 2600, an English grammar textbook consisting of 2600 frames.

Perhaps the most successful application of scrambled book techniques has been the development of the Sullivan Reading Series currently being marketed by Behavioral Research Laboratories, and comprising the basis for Project Read. The Sullivan Reading Series is a completely programmed scrambled book approach to the teaching of reading from pre-primer level through third grade.

The programmed instruction movement peaked in the mid and late 60's, however. One of the problems with scrambled book programmed instruction was that it was often a long and tedious way for a student to learn. Students often preferred simply to read the textbook and get it over with. Programmed instruction is still widely used for remedial purposes, however.

The early emphasis on machine mediation gave way to the ultimate in machine mediation, computer assisted instruction (CAI), where the computer operates as a maximally sophisticated teaching machine. The computer presents the content to the student, scores his response, makes decisions based on the quality and speed of the student's response, recommends review when needed, recommends termination of the day's practice when the student's error rate begins to rise above certain threshold, or his response rate begins to decrease showing signs of fatigue or disinterest, and the like. (See Zinn, 1967).

Sophisticated computer assisted instruction can involve not only written verbal interchange between the student and the computer, but also the coordinated use of a wide range of audio visual materials. In addition to single audio-visual presentation, a student can draw figures on a cathode ray tube, and the computer can show pictures and rotate them through various positions in space so that the student can see them from a variety of perspectives.

Major problems with computer assisted instruction, however, are its extremely high cost per student hour of utilization, and the extremely high cost for materials development, that is, program development (or as it is called in the technical jargon, software development).

Major applications of computer assisted instruction may be found in the work of Suppes at Stanford University and the work of Duncan Hansen at Florida State University.

The successor to the non-machine mediated programmed instruction and scrambled book concern of the early 1960's has matured into what might be called macroprogramming. Macroprogramming includes the selection, sequencing and modification of instructional materials in much larger units than the old scrambled book frame. An example of an outgrowth of this early concern for traditional programmed instruction can be seen in the development of the project called Individually Prescribed Instruction, which will be described in the following section.

An interesting merger of the two disparate approaches, macro-programming and computer utilization may be seen in the development of what is called computer managed instruction (CMI). Computer managed instruction is an effort to bring the resources of high speed digital computation afforded by the computer to bear on non-machine mediated macro programs such as IPI. Under CAI the computer is in actual control of the instructional process whereas in CMI the teacher is in control of instruction. The computer simply provides clerical service, test scoring and other backup support service for the teacher.

Summary

In summary, there have been four major approaches toward the individualization of education which seem to represent the majority of efforts so far: 1) models concerned with differentiated grouping of students or of teachers; 2) individual student response systems; 3) progressive education models; and 4) structured curriculum models. Of course, any particular program for individualizing education may in fact involve a combination of two or more of these types of efforts.

CHAPTER 3

CONTEMPORARY EFFORTS AT INDIVIDUALIZING EDUCATION

Whereas the latter part of the 1950's was characterized by a rapid increase in programmed instruction and the early and mid 1960's by a rapid increase in the use of hardware in programmed instruction, the latter part of the 1960's (and early 1970's) has been characterized by the attempt first to analyze the needs of schools and then to apply the results of basic and applied research on instruction and management of instruction in a coordinated way.

These efforts have usually involved broad scale application of technological principles to large areas of the curriculum and may be best described as general systems approaches. They are typically on the order of magnitude, or even exceed the order of magnitude, of the Winnetka Plan, but differ in that whereas the Winnetka Plan evolved over a quarter of a century, these programs were developed often in a matter of only a few years. The emergence of general systems theory and systems planning and development techniques have greatly aided these efforts.

David Ryans (1964) in an early application of systems concepts to educational planning has written:

> The individuals, facilities, organizations, and activities involved in education may be thought of as comprising a very complex system--an octopus-like metasystem made up of a number of identifiable sub-systems, each of which possess unique characteristics and each of which is complex in its own right. A single individual such as an instructor, (or a student, if you wish) may be conceptualized as a system made up of a number of sub-systems; the classroom consisting of instructor, students, learning medium, and other facilities, certainly may be viewed as a system; an academic department is expected to operate as a system; a university as a whole represents a system (page 11).

In his systems analysis of various aspects of education, Ryans had the following to say:

> In the area of student personnel we find one of the most obvious effects of less than optimal use of systems study and design and attendant information processing. Information about

> students (e.g., previous records and reports, test scores, information about students' homes and economic conditions, etc.) is not readily available to teachers, counselors, and administrators due to inefficient information, storage, and processing. Similarly, the counseling function in schools and colleges which is potentially important in guiding and advising students, often is inefficient due to poor availability of information to the counselor, inability of the counselor to transmit useful information to the student properly, and inadequate feedback of information about students to counselors, administrators, and teachers.
>
> In the field of instruction, the transmission of information through teacher, textbook, demonstration, laboratory experiment, teaching machine, or programmed lessons etc. is often hampered by inadequate establishment in the student of the background (i.e., state of readiness) necessary for receiving the information upon which the lesson is focused, by effective methods of presentation characterized by poor information filtering, channeling, and programming on the teacher's part; by excessive interference; and by little or no feedback of results to the student, teacher, curriculum planner, textbook writer or others charged with arranging and presenting the content to be learned . . . (page 12).
>
> These and other inadequacies in systems design and information control contribute significantly to much recognized, and often highly publicized, problems of education such as inadequate provision for individual differences, neglect of remedial teaching/learning (in spite of the fact that one third of our able students are underachievers), and student failure and maladjustment (page 13).

Ryans goes on to say:

> The introduction in the system of an organizational unit which is concerned exclusively with "information processing" may be an effective way of alleviating some of the problems of information exchange in inefficient system operation. I refer to an organizational unit which may be manually operated or may be operated by persons aided by a computer, that provides an information storage, retrieval, transforming, and relaying station for the college. Such a unit would be equipped to handle student data, curriculum data, administrative data, and faculty data, etc. of various kinds. It would store information from a variety of sources, classify the information, store or file it, retrieve it on request, transform it in accord with the need of the requestor, and relay the information in an efficient manner, I will not dwell on this, but I suggest it may be an important consideration in educational system design for the future . . . (page 13).

At the time Ryans was writing these words a major effort was already under way to promote the development of such an instructional program. Less than three years later a ten million dollar developmental effort was in progress. This effort, called Project PLAN, will be described in some detail in the pages that follow.

PLAN

PLAN[1] represents the most comprehensive effort yet taken at the individualization of education. PLAN stands for Program for Learning in Accordance with Needs and was the product of a cooperative effort between the American Institutes for Research, 14 public school systems, and the Westinghouse Learning Corporation.

In 1965 John C. Flanagan, President of the American Institutes for Research (AIR), initiated dialogue with the superintendents of a number of public school systems to explore the possibility of bringing as much power of psychology and educational technology as possible to bear on the task of making education more relevant to the needs of children. Fourteen school systems eventually entered into a cooperative relationship with AIR. In January, 1967, the group signed a contract with Westinghouse Learning Corporation for a three and one-half year developmental effort. The aggregate cost of the project to be shared by AIR, the school districts, and the Westinghouse Learning Corporation was eventually ten million dollars.

Origin and Goals. PLAN had its origin in the findings of an undertaking called Project TALENT. Project TALENT was a national assessment of the abilities, interests, and aspirations of American youth. The TALENT sample tested in 1960 consisted of a nationally representative sample of over 400,000 high school youth. A follow-up testing of 12,722 cases was made in 1971.

TALENT dramatically confirmed the great variance in levels of ability that were manifested by students by the time they reached high school age. For example, approximately 1 out of every 4 ninth grade students was functioning at the twelfth grade level in English and Social Studies. On the other hand, a comparable number of students were functioning at only the sixth grade level.

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[1] This material taken from Dunn, J.A., The Guidance Program in the PLAN System of Individualized Education. The reader desiring a more complete description of the PLAN System should contact the author.

When one considers the functional meaning of twelfth grade reading ability, however, one's perspective changes. Just how good is the reading comprehension of the average twelfth grade student? What can the typical twelfth grade student read and comprehend? Seventy-two percent of the twelfth grade students could read and pass tests on their comprehension of the writing of Robert Louis Stevenson, only 45 percent could pass comprehension tests on sample Reader's Digest articles, and only 4 percent could comprehend Saturday Review articles. Only 25 percent were able to answer correctly half or more of the test items on typical paragraphs from Time magazine.

> These results suggest that today's high school graduates are ill equipped to evaluate the evidence and make wise decisions in choices with respect to important national issues (Flanagan, 1970, page 191).

TALENT also documented the great fluidity of student's vocational goals. On the average, of every 12 male high school seniors, only 2 still held the same general vocational aspirations 5 years later.

Clearly, ways needed to be found to not only individualize instruction but also to revamp that instruction, to make it more relevant to the needs of youth in our contemporary society. If schools were to assist students eventually to become responsible for their own personal development, they needed to help the student acquire, in addition to formal academic content: knowledge of available choices of occupational roles, leisure-time activities, social and civic responsibilities; knowledge of individual differences, the principles of learning, behavior management, and prospects for the development and/or changeability of interests and values; skills in the recognition and assessment of one's own personal abilities, interests, and values; skills in personal goal formation and the assessment of the implications of those goals; and skills in managing one's own personal progress toward those goals.

These, then, formed the overall ambition of Project PLAN. Specifically, the goal of PLAN was to develop a practical educational system which could assist schools to move toward those goals.

The Components of PLAN. Conceptually, PLAN may be considered in terms of three major components: The first encompassing all those elements which might loosely be called Instructional Resources. The instructional resources of PLAN involve 6,000 instructional objectives incorporated in 2,600 discrete teaching/learning units utilizing 12,000 items of instructional material. There are 1,500 criterion referenced performance tests, 133 PLAN achievement tests, and special guidance tests based on the TALENT data base. This constitutes approximately two and one-half times as much material as would normally be studied by an average student during his twelve years of public school experience.

The second main component was the Guidance System which was responsible for: helping define and configure the instructional resources available in PLAN; for the creation of student guidance programs; and for the development and operation of the procedures for the generation of individualized educational programs. These latter entities were called Programs of Study or POS's.

The third major component of PLAN comprised those Support Services essential for the implementation and continued operation of the program. These included computer service, teacher training, and materials procurement, production, and distribution.

In brief, the domain of instructional content in PLAN is defined by instructional objectives. There are three levels of objectives: 1. instructional objectives which generally take two to three hours of study time to master, 2. curricular objectives which subsume a number of instructional objectives and usually take six to eight weeks to master, and 3. long-range objectives which may take a year or more to master. Examples of this objectives hierarchy might be: divide simple two digit numbers by one digit numbers, perform long division, and master arithmetic operations with whole numbers.

Instructional objectives were grouped into units of study called modules. Materials were then developed to guide the student's study of these objectives. Three to four alternative units were developed for each module. These study units were called Teaching/Learning Units. They provided for individualization of instructional method. End-of-module tests were developed to assess achievement of the module objectives. The same end-of-module test was used regardless of the particular TLU used because all TLU's for the same module were concerned with the same set of objectives. The student could take the module test whenever he or his teacher thought he was ready. He need not complete all of the activities of the TLU if he thought he could demonstrate mastery of the objectives. Figure 3-1 summarizes the module decision process.

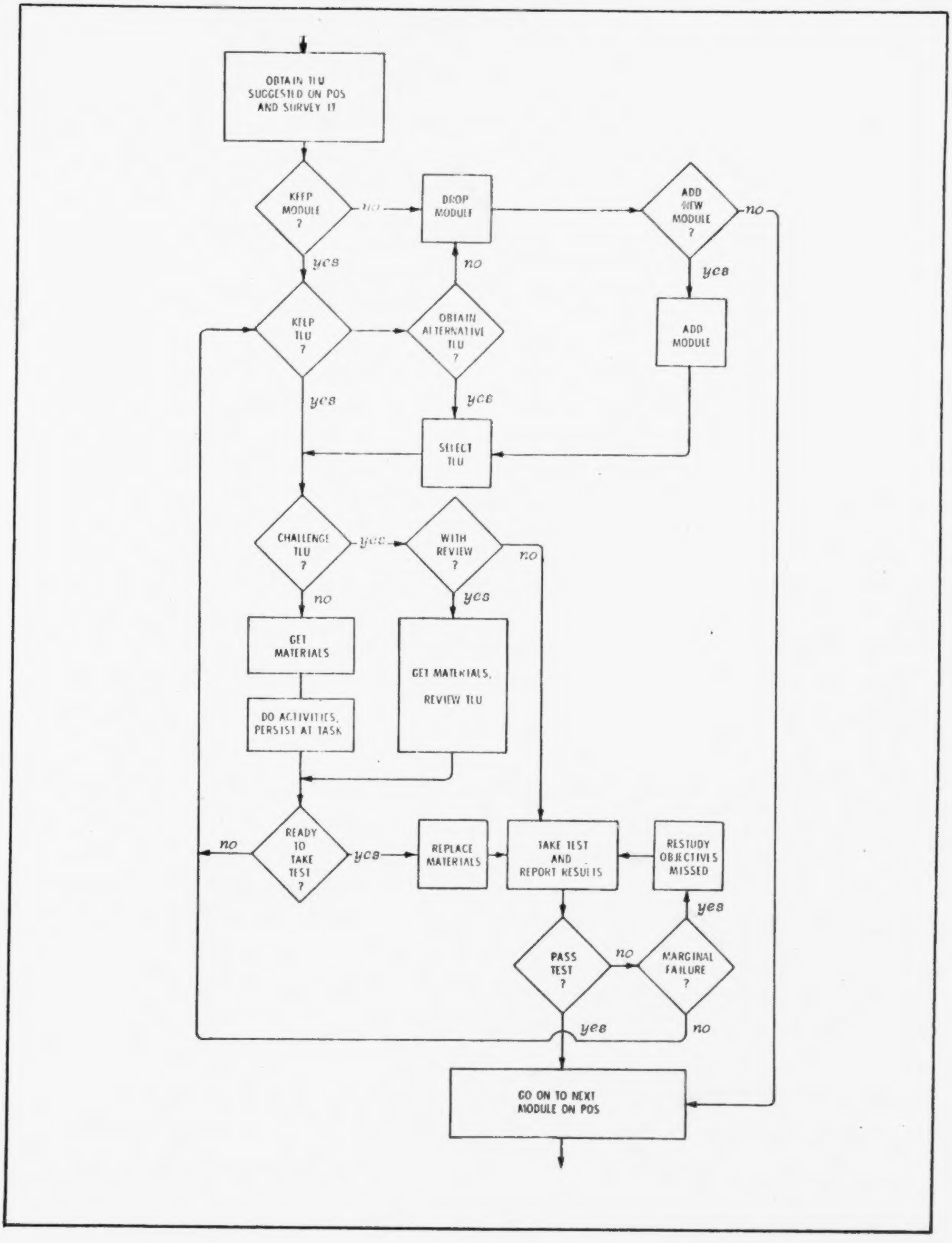
Modules were sometimes clustered together to form larger instructional blocks. These were called module clusters. Survey tests were used to assess retention of mastery across these larger sets of module objectives. Finally, at the end of the year, assessment was made of the student's final level of performance preparatory to placement for the coming year.

Scope of PLAN. The PLAN instructional system encompasses the full spectrum of basic academic education for grades 1 - 12. It includes five different reading programs as well as literature, composition, public speaking, grammar, listening skills, and the like in the Language Arts area. Science begins in Grade One and includes, at the upper grade levels, Earth Science, Chemistry, Physics, and Biology. Social Studies also begins in Grade One and includes History, Geography and Economics as well as basic elements of Sociology, Anthropology, Psychology and Political Science. Mathematics also begins in Grade One and runs through first year Calculus at the twelfth grade level.

Teachers are free to organize the classroom any way they choose; they are free to team teach, use differential staffing, and the like. The system does not require any personnel other than those the school would normally employ. Nor does it require any special organization or configuration of the classroom. Typically, however, teachers find it convenient to organize the classroom so that one area is designated as the quiet area where the students can study independently and take tests without fear of much distraction.

FIGURE 3-1

The Module Decision Process


OBTAIN TLU SUGGESTED ON POS AND SURVEY IT
KEEP MODULE ?
no
DROP MODULE
ADD NEW MODULE ?
no
yes
no
yes
KEEP TLU ?
OBTAIN ALTERNATIVE TLU ?
ADD MODULE
yes
yes
SELECT TLU
CHALLENGE TLU ?
yes
WITH REVIEW ?
no
no
yes
GET MATERIALS
GET MATERIALS, REVIEW TLU
DO ACTIVITIES, PERSIST AT TASK
no
READY TO TAKE TEST ?
yes
REPLACE MATERIALS
TAKE TEST AND REPORT RESULTS
RESTUDY OBJECTIVES MISSED
yes
PASS TEST ?
no
MARGINAL FAILURE ?
yes
no
GO ON TO NEXT MODULE ON POS

Individualized Programs of Study. It is through the program of studies (POS) that PLAN hopes to individualize more fully a student's education. The POS attempts to individualize content and instructional method as well as quota and length of exposure time. In particular, the POS considers:

1. What the student needs to know;
2. What the student already knows;
3. What the student would like to know;
4. The rate at which the selected content should be presented;
5. The sequence in which the content should be presented;
6. The mode of presentation of that content;
7. The difficulty of level of the learning materials used to teach the content;
8. The nature of the physical and social context in which the teaching/learning takes place;
9. The amount of teacher supervision, media-richness, and technology involved;
10. Student-parent long-range goals and aspirations;
11. The student's level of developed abilities.

Figure 3 - 2 summarizes the various sources of input to the PLAN POS.

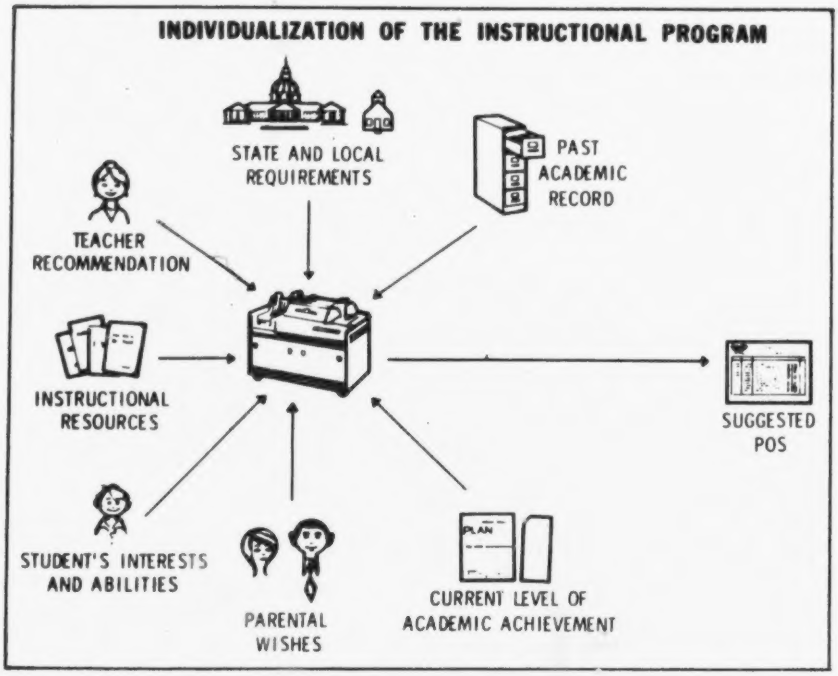
A secondary school student's Recommended Program of Studies is produced as follows: First, information as to the student's long-range goal aspirations is obtained.

Next, data with regard to the student's interests, achievement levels, and developed abilities are obtained. From information about the student's developed abilities, a second long-range vocational goal is generated for the student, using TALENT-based regression equations. This "data suggested" long-range goal (LRG) is used to supplement the parent-student planning so as to have an alternative option open for the student. The student's two (LRG) categories plus his expressed interests then play the major role in determining what content will be recommended for him.

Next, information regarding any special state or local school system requirements is retrieved. At this point the computer is ready to search out

FIGURE 3-2

Sources of Input to the PLAN POS


INDIVIDUALIZATION OF THE INSTRUCTIONAL PROGRAM
STATE AND LOCAL REQUIREMENTS
PAST ACADEMIC RECORD
TEACHER RECOMMENDATION
INSTRUCTIONAL RESOURCES
SUGGESTED POS
STUDENT'S INTERESTS AND ABILITIES
PARENTAL WISHES
PLAN
CURRENT LEVEL OF ACADEMIC ACHIEVEMENT

those modules considered most important for the student to take. To do this the computer must search among 250,000 module descriptor codes in its decision-making process.

The Individualization of Content: Module Selection. Given information about a student's long-range goals, his expressed interests, citizenship requirements, and state and local school requirements, the computer generates a list of recommended modules arranged in the following order: 1. state requirements; 2. local requirements; 3. essential citizenship requirements; 4. parent-student long-range goal requirements; 5. parent-student long-range goal highly desirable modules; 6. computer-recommended LRG highly desired experiences. Depending on the student's LRG pattern, this list may represent from three to five years worth of work.

The student's past history is then searched to see what he has already mastered and to see if he has the necessary academic foundations to pursue the work that will be expected him in the coming year. Next, the student's achievement test results are considered to see if there is anything from the past year's material that needs to be reviewed and what, if anything, from the coming year's work he may already know. These procedures define what might be described as the core content of the student's future POS.

These core requirements are then projected across the time remaining for the student to study that particular area. If the student's POS called for less than three years of mathematics, the length of time allotted to mathematics would depend on his past performance rate in mathematics, unless there was a scheduling limit placed on the planning by the student. If on the other hand, his POS called for more study than time permitted, if say, it recommended four years of mathematics as desirable for the student given his LRG pattern, and there were only three years remaining, the POS would design a "heavy load" program for the student, and explain why it was so heavy, advise him that if he wished to pursue his LRG to his best advantage, he should either revise upward the total number of years he expects to spend studying in that area or if that is impossible, increase the amount of time and effort he will devote to the study of that subject in the time he has left.

After the basic, or core requirements are identified and distributed across the balance of the time expected to be devoted to the study of that content, attention is then turned to determining how much of the requisite material should be taken in the immediately ensuing year. If n is the number of years remaining to study in an area, then the student is assigned at least 1/n of the required modules. Typically the core requirements constitute much less than a year's worth of study, so attention must shift to the assignment of modules to augment these basic core modules. To do this, consideration must be given to determining what is a reasonable amount of work for the student to cover in a year.

This is determined by taking into consideration both the student's level of developed abilities, as determined by a battery of tests administered in the Spring, and also the number of modules the student completed the preceding year.

In the event that a student's quota is not filled by the 1/n requirement (an almost guaranteed condition), the POS then begins to assign lessons that are considered highly desirable for the student to take. These are lessons not considered to be absolutely essential for further academic progress but which are nevertheless considered to be very important, basic content for the student to learn.

If upon completion of assignment of these highly desirable lessons the student's quota for the year is still not filled, the remainder of the quota is divided evenly between lessons expected to appeal to the special interests of the student and to the assignment of required modules from the next higher level. Assignment of modules of this latter type permits some measure of student acceleration without sacrificing curriculum enrichment.

After module selection and quota determination, attention is then directed to module sequencing. Many modules are, of course, sequenced by the logical development of the content. Mathematics is a good case in point; but even in mathematics, there are units of material which need not follow a rigid sequence within the year. Indeed, in the areas of Social Studies and Literature a great deal may be studied sequence free. All modules in the system are coded as to their sequence characteristics; and indeed, some modules are coded to be collaterally sequenced across subject matter areas. The correlation of the study of the metric system in mathematics and measurement in science is an example.

Individualization of Method: Teaching--Learning Unit Selection. At this point, specific teaching learning unit (TLU) assignment takes place. Up to now the consideration has only been of identification of the content to be studied, i.e., which lessons, how many lessons, and in what sequence the lessons should be taken. Now we are faced with the question of learning style, i.e., what particular TLU's the student should take to study the assigned lessons so as to maximize the likelihood of his mastering the content as quickly as possible. It is at this point that the computer matches the student with specific TLU's.

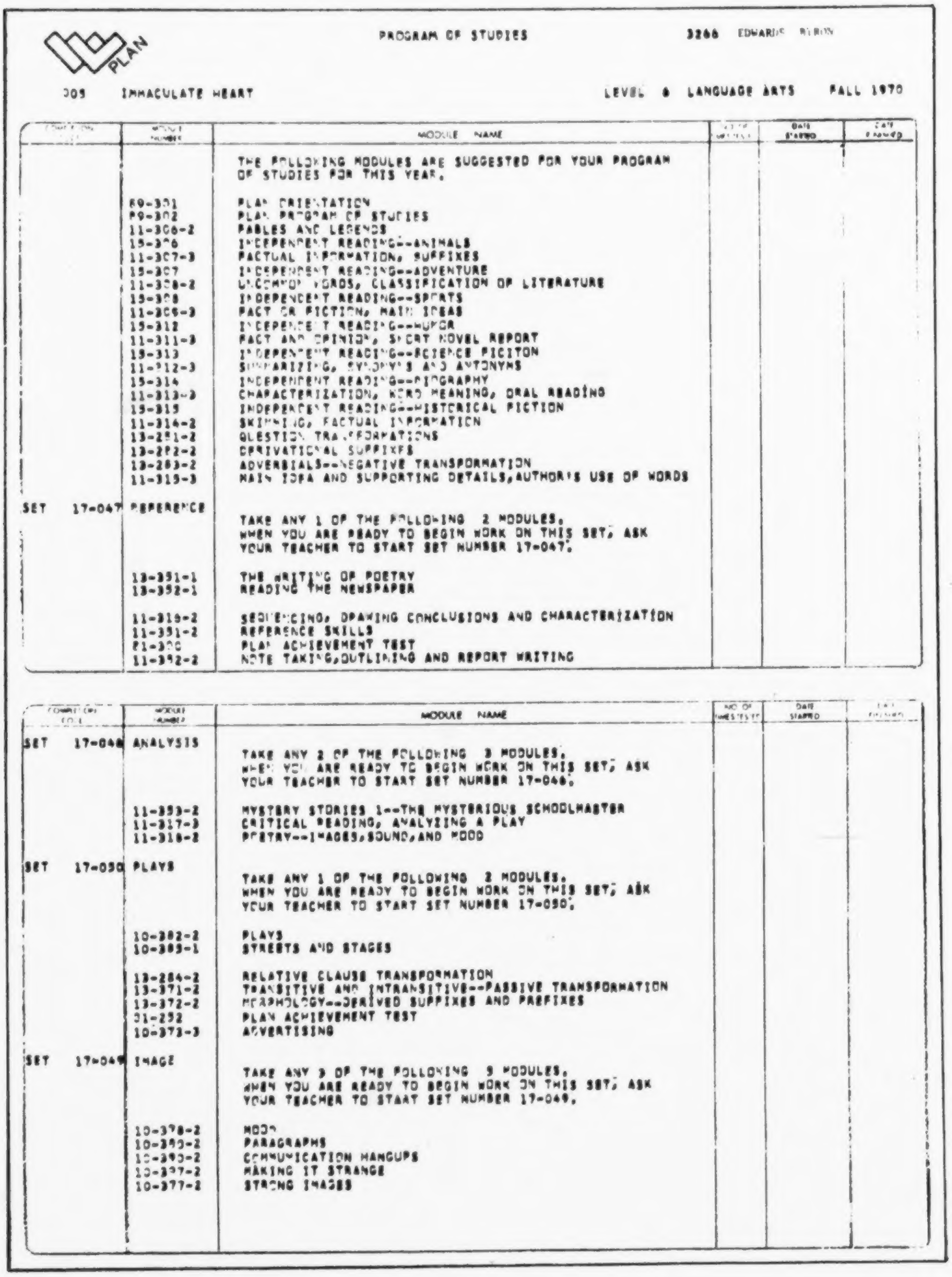
The results of these computer-generated decisions are then printed as a formal Program of Study for the student. Results are printed in two copies, one for school record keeping, and the other for teacher-student classroom use. Figures 3-3, 4, 5, and 6 show samples of various POS's.

Each teaching-learning unit is coded as to its reading difficulty, the degree to which it requires teacher supervision, its media richness characteristic, the degree to which it requires social involvement and/or group learning activities, the amount of reading involved, and the variety of activities inherent in the unit. Related data regarding the student is obtained from data inputs from the teacher and student test results.

The POS module assignment and TLU matching rules are not best-fit rules, however, since one wants a student's program to stretch the student a little, to broaden his interests and strain his intellectual ability a little, and lead him a little further down the educational road than he might ordinarily go. Best fit is called for in only an arbitrary percentage of the time,

FIGURE 3-3

Sample of POS Format



PLAN

PROGRAM OF STUDIES

3266 EDWARDS BYRON

305 IMMACULATE HEART

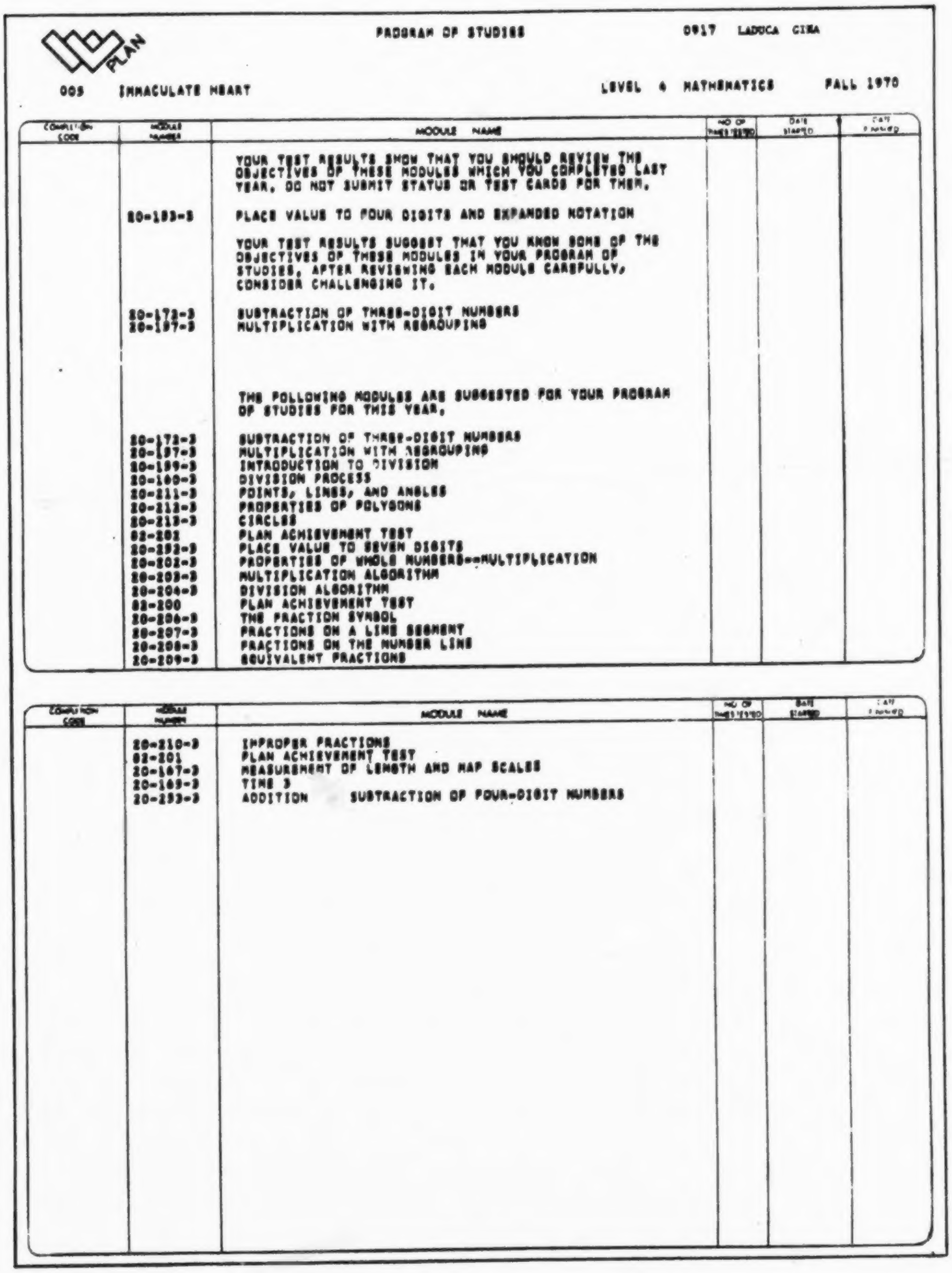
LEVEL 6 LANGUAGE ARTS FALL 1970

COMPLETION CODE	MODULE NUMBER	MODULE NAME	NO. OF TIMES TESTED	DATE STARTED	DATE FINISHED
		THE FOLLOWING MODULES ARE SUGGESTED FOR YOUR PROGRAM OF STUDIES FOR THIS YEAR.			
	F9-301	PLAN ORIENTATION			
	F9-302	PLAN PROGRAM OF STUDIES			
	11-306-2	FABLES AND LEGENDS			
	15-306	INDEPENDENT READING--ANIMALS			
	11-307-3	FACTUAL INFORMATION, SUFFIXES			
	15-307	INDEPENDENT READING--ADVENTURE			
	11-308-2	UNCOMMON WORDS, CLASSIFICATION OF LITERATURE			
	15-308	INDEPENDENT READING--SPORTS			
	11-309-3	FACT OR FICTION, MAIN IDEAS			
	15-312	INDEPENDENT READING--HUMOR			
	11-311-3	FACT AND OPINION, SHORT NOVEL REPORT			
	15-313	INDEPENDENT READING--SCIENCE FICITON			
	11-312-3	SUMMARIZING, SYNONYMS AND ANTONYMS			
	15-314	INDEPENDENT READING--BIOGRAPHY			
	11-313-3	CHARACTERIZATION, WORD MEANING, ORAL READING			
	15-315	INDEPENDENT READING--HISTORICAL FICTION			
	11-314-2	SKIMMING, FACTUAL INFORMATION			
	13-281-2	QUESTION TRANSFORMATIONS			
	13-282-2	DERIVATIONAL SUFFIXES			
	13-283-2	ADVERBIALS--NEGATIVE TRANSFORMATION			
	11-315-3	MAIN IDEA AND SUPPORTING DETAILS,AUTHOR'S USE OF WORDS			
SET 17-047	REFERENCE	TAKE ANY 1 OF THE FOLLOWING 2 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 17-047.			
	13-351-1	THE WRITING OF POETRY			
	13-352-1	READING THE NEWSPAPER			
	11-319-2	SEQUENCING, DRAWING CONCLUSIONS AND CHARACTERIZATION			
	11-351-2	REFERENCE SKILLS			
	F1-300	PLAN ACHIEVEMENT TEST			
	11-352-2	NOTE TAKING,OUTLINING AND REPORT WRITING			

COMPLETION CODE	MODULE NUMBER	MODULE NAME	NO. OF TIMES TESTED	DATE STARTED	DATE FINISHED
SET 17-048	ANALYSIS	TAKE ANY 2 OF THE FOLLOWING 3 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 17-048.			
	11-353-2	MYSTERY STORIES 1--THE MYSTERIOUS SCHOOLMASTER			
	11-317-3	CRITICAL READING, ANALYZING A PLAY			
	11-318-2	POETRY--IMAGES,SOUND,AND MOOD			
SET 17-050	PLAYS	TAKE ANY 1 OF THE FOLLOWING 2 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 17-050.			
	10-382-2	PLAYS			
	10-383-1	STREETS AND STAGES			
	13-284-2	RELATIVE CLAUSE TRANSFORMATION			
	13-371-2	TRANSITIVE AND INTRANSITIVE--PASSIVE TRANSFORMATION			
	13-372-2	MORPHOLOGY--DERIVED SUFFIXES AND PREFIXES			
	31-252	PLAN ACHIEVEMENT TEST			
	10-373-3	ADVERTISING			
SET 17-049	IMAGE	TAKE ANY 3 OF THE FOLLOWING 5 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 17-049.			
	10-378-2	MOOD			
	10-380-2	PARAGRAPHS			
	10-393-2	COMMUNICATION HANGUPS			
	10-397-2	MAKING IT STRANGE			
	10-377-2	STRONG IMAGES			

FIGURE 3-4

Sample POS #1



PROGRAM OF STUDIES   0917 LADUCA CIRA

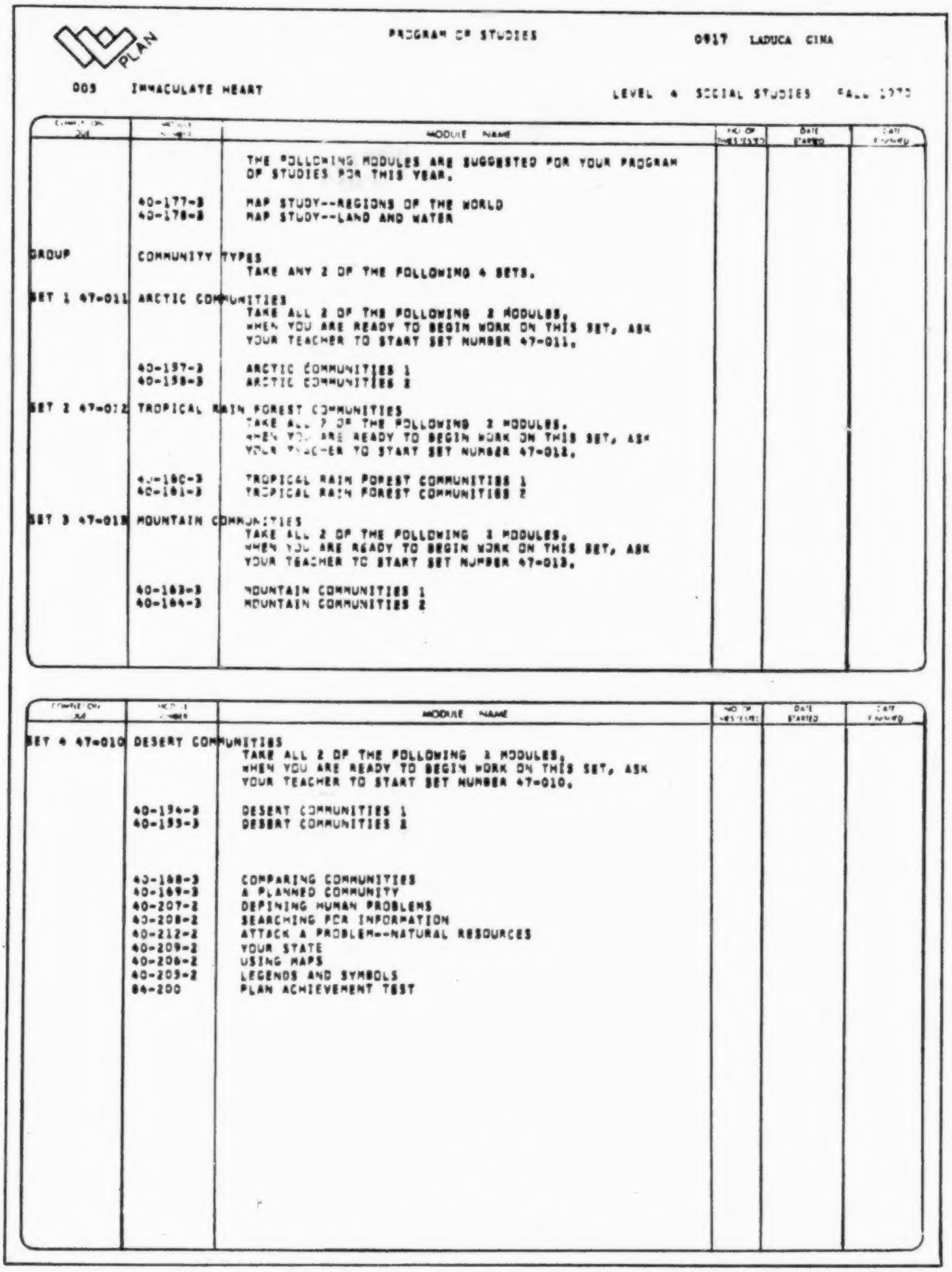
005 IMMACULATE HEART   LEVEL 4 MATHEMATICS   FALL 1970

COMPLETION CODE	MODULE NUMBER	MODULE NAME	NO OF TIMES TESTED	DATE STARTED	DATE FINISHED
		YOUR TEST RESULTS SHOW THAT YOU SHOULD REVIEW THE OBJECTIVES OF THESE MODULES WHICH YOU COMPLETED LAST YEAR, DO NOT SUBMIT STATUS OR TEST CARDS FOR THEM,			
	20-153-3	PLACE VALUE TO FOUR DIGITS AND EXPANDED NOTATION			
		YOUR TEST RESULTS SUGGEST THAT YOU KNOW SOME OF THE OBJECTIVES OF THESE MODULES IN YOUR PROGRAM OF STUDIES, AFTER REVIEWING EACH MODULE CAREFULLY, CONSIDER CHALLENGING IT.			
	20-172-3	SUBTRACTION OF THREE-DIGIT NUMBERS			
	20-197-3	MULTIPLICATION WITH REGROUPING			
		THE FOLLOWING MODULES ARE SUGGESTED FOR YOUR PROGRAM OF STUDIES FOR THIS YEAR,			
	20-172-3	SUBTRACTION OF THREE-DIGIT NUMBERS			
	20-197-3	MULTIPLICATION WITH REGROUPING			
	20-199-3	INTRODUCTION TO DIVISION			
	20-100-3	DIVISION PROCESS			
	20-211-3	POINTS, LINES, AND ANGLES			
	20-212-3	PROPERTIES OF POLYGONS			
	20-213-3	CIRCLES			
	82-201	PLAN ACHIEVEMENT TEST			
	20-252-3	PLACE VALUE TO SEVEN DIGITS			
	20-202-3	PROPERTIES OF WHOLE NUMBERS--MULTIPLICATION			
	20-203-3	MULTIPLICATION ALGORITHM			
	20-204-3	DIVISION ALGORITHM			
	82-200	PLAN ACHIEVEMENT TEST			
	20-206-3	THE FRACTION SYMBOL			
	20-207-3	FRACTIONS ON A LINE SEGMENT			
	20-208-3	FRACTIONS ON THE NUMBER LINE			
	20-209-3	EQUIVALENT FRACTIONS			

COMPLETION CODE	MODULE NUMBER	MODULE NAME	NO OF TIMES TESTED	DATE STARTED	DATE FINISHED
	20-210-3	IMPROPER FRACTIONS			
	82-201	PLAN ACHIEVEMENT TEST			
	20-167-3	MEASUREMENT OF LENGTH AND MAP SCALES			
	20-169-3	TIME 3			
	20-233-3	ADDITION SUBTRACTION OF FOUR-DIGIT NUMBERS			

FIGURE 3-5

Sample POS #2



PROGRAM OF STUDIES

0917 LADUCA CINA

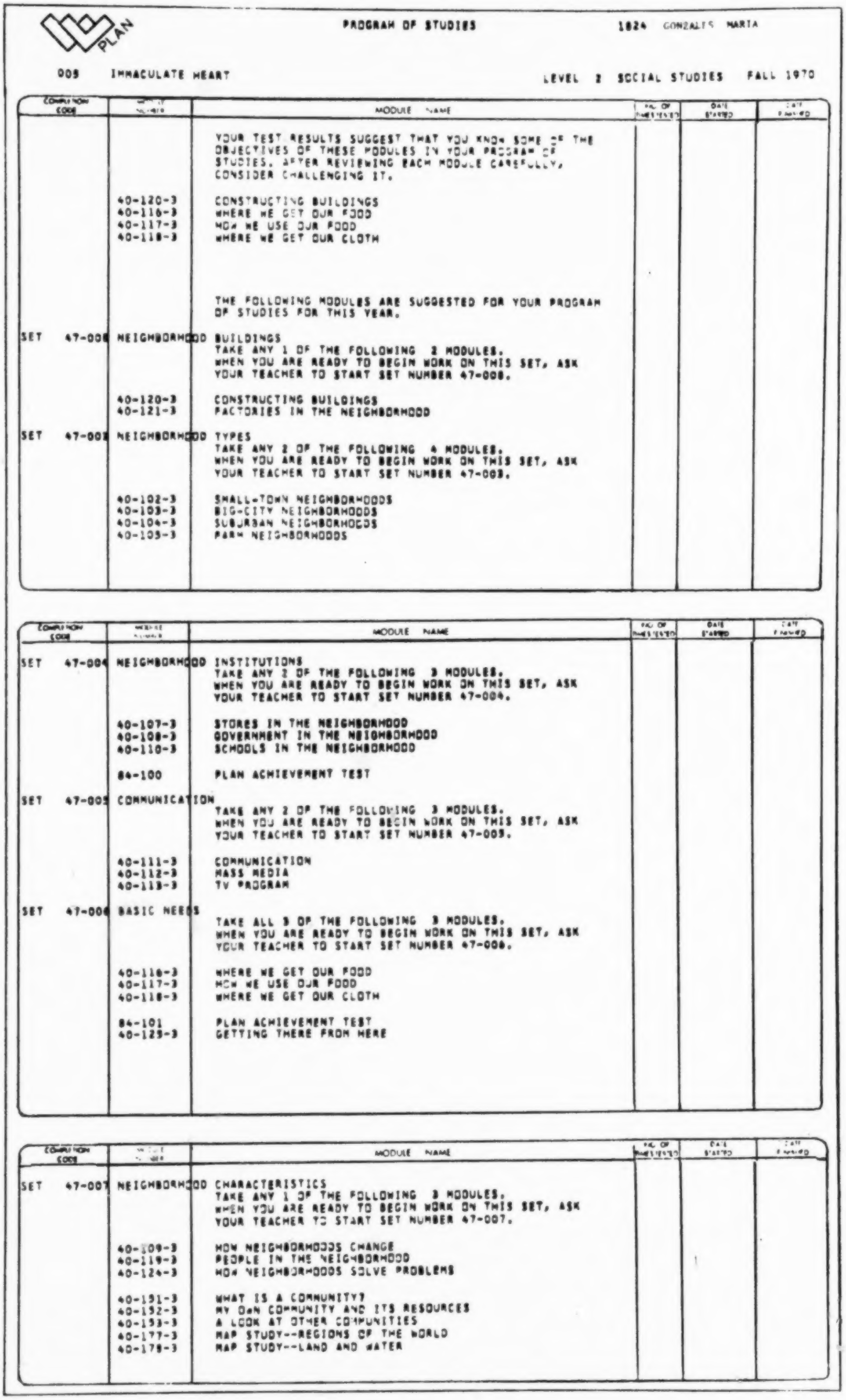
003 IMMACULATE HEART

LEVEL 4 SOCIAL STUDIES FALL 197[illegible]

[illegible]	MODULE NUMBER	MODULE NAME	NO. OF TIMES TESTED	DATE STARTED	DATE FINISHED
		THE FOLLOWING MODULES ARE SUGGESTED FOR YOUR PROGRAM OF STUDIES FOR THIS YEAR.			
	40-177-3	MAP STUDY--REGIONS OF THE WORLD			
	40-178-3	MAP STUDY--LAND AND WATER			
GROUP	COMMUNITY TYPES	TAKE ANY 2 OF THE FOLLOWING 4 SETS.			
SET 1 47-011	ARCTIC COMMUNITIES	TAKE ALL 2 OF THE FOLLOWING 2 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 47-011.			
	40-157-3	ARCTIC COMMUNITIES 1			
	40-158-3	ARCTIC COMMUNITIES 2			
SET 2 47-012	TROPICAL RAIN FOREST COMMUNITIES	TAKE ALL 2 OF THE FOLLOWING 2 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 47-012.			
	40-160-3	TROPICAL RAIN FOREST COMMUNITIES 1			
	40-161-3	TROPICAL RAIN FOREST COMMUNITIES 2			
SET 3 47-013	MOUNTAIN COMMUNITIES	TAKE ALL 2 OF THE FOLLOWING 2 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 47-013.			
	40-163-3	MOUNTAIN COMMUNITIES 1			
	40-164-3	MOUNTAIN COMMUNITIES 2			
SET 4 47-010	DESERT COMMUNITIES	TAKE ALL 2 OF THE FOLLOWING 2 MODULES. WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK YOUR TEACHER TO START SET NUMBER 47-010.			
	40-154-3	DESERT COMMUNITIES 1			
	40-155-3	DESERT COMMUNITIES 2			
	40-168-3	COMPARING COMMUNITIES			
	40-169-3	A PLANNED COMMUNITY			
	40-207-2	DEFINING HUMAN PROBLEMS			
	40-208-2	SEARCHING FOR INFORMATION			
	40-212-2	ATTACK A PROBLEM--NATURAL RESOURCES			
	40-209-2	YOUR STATE			
	40-206-2	USING MAPS			
	40-205-2	LEGENDS AND SYMBOLS			
	84-200	PLAN ACHIEVEMENT TEST			

FIGURE 3-6

Sample POS #3



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PLAN                     PROGRAM OF STUDIES                1824  GONZALES  MARIA

  005    IMMACULATE HEART                          LEVEL  2  SOCIAL STUDIES   FALL 1970

COMPLETION  MODULE                                              NO. OF        DATE     DATE
  CODE      NUMBER       MODULE NAME                            TIMES TESTED  STARTED  FINISHED

                         YOUR TEST RESULTS SUGGEST THAT YOU KNOW SOME OF THE
                         OBJECTIVES OF THESE MODULES IN YOUR PROGRAM OF
                         STUDIES. AFTER REVIEWING EACH MODULE CAREFULLY,
                         CONSIDER CHALLENGING IT.

            40-120-3     CONSTRUCTING BUILDINGS
            40-116-3     WHERE WE GET OUR FOOD
            40-117-3     HOW WE USE OUR FOOD
            40-118-3     WHERE WE GET OUR CLOTH


                         THE FOLLOWING MODULES ARE SUGGESTED FOR YOUR PROGRAM
                         OF STUDIES FOR THIS YEAR.

SET    47-008 NEIGHBORHOOD BUILDINGS
                         TAKE ANY 1 OF THE FOLLOWING  2 MODULES.
                         WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK
                         YOUR TEACHER TO START SET NUMBER 47-008.

            40-120-3     CONSTRUCTING BUILDINGS
            40-121-3     FACTORIES IN THE NEIGHBORHOOD

SET    47-003 NEIGHBORHOOD TYPES
                         TAKE ANY 2 OF THE FOLLOWING  4 MODULES.
                         WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK
                         YOUR TEACHER TO START SET NUMBER 47-003.

            40-102-3     SMALL-TOWN NEIGHBORHOODS
            40-103-3     BIG-CITY NEIGHBORHOODS
            40-104-3     SUBURBAN NEIGHBORHOODS
            40-105-3     FARM NEIGHBORHOODS

COMPLETION  MODULE                                              NO. OF        DATE     DATE
  CODE      NUMBER       MODULE NAME                            TIMES TESTED  STARTED  FINISHED

SET    47-004 NEIGHBORHOOD INSTITUTIONS
                         TAKE ANY 2 OF THE FOLLOWING  3 MODULES.
                         WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK
                         YOUR TEACHER TO START SET NUMBER 47-004.

            40-107-3     STORES IN THE NEIGHBORHOOD
            40-108-3     GOVERNMENT IN THE NEIGHBORHOOD
            40-110-3     SCHOOLS IN THE NEIGHBORHOOD

            84-100       PLAN ACHIEVEMENT TEST

SET    47-005 COMMUNICATION
                         TAKE ANY 2 OF THE FOLLOWING  3 MODULES.
                         WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK
                         YOUR TEACHER TO START SET NUMBER 47-005.

            40-111-3     COMMUNICATION
            40-112-3     MASS MEDIA
            40-113-3     TV PROGRAM

SET    47-006 BASIC NEEDS
                         TAKE ALL 3 OF THE FOLLOWING  3 MODULES.
                         WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK
                         YOUR TEACHER TO START SET NUMBER 47-006.

            40-116-3     WHERE WE GET OUR FOOD
            40-117-3     HOW WE USE OUR FOOD
            40-118-3     WHERE WE GET OUR CLOTH

            84-101       PLAN ACHIEVEMENT TEST
            40-125-3     GETTING THERE FROM HERE

COMPLETION  MODULE                                              NO. OF        DATE     DATE
  CODE      NUMBER       MODULE NAME                            TIMES TESTED  STARTED  FINISHED

SET    47-007 NEIGHBORHOOD CHARACTERISTICS
                         TAKE ANY 1 OF THE FOLLOWING  3 MODULES.
                         WHEN YOU ARE READY TO BEGIN WORK ON THIS SET, ASK
                         YOUR TEACHER TO START SET NUMBER 47-007.

            40-109-3     HOW NEIGHBORHOODS CHANGE
            40-119-3     PEOPLE IN THE NEIGHBORHOOD
            40-124-3     HOW NEIGHBORHOODS SOLVE PROBLEMS

            40-151-3     WHAT IS A COMMUNITY?
            40-152-3     MY OWN COMMUNITY AND ITS RESOURCES
            40-153-3     A LOOK AT OTHER COMMUNITIES
            40-177-3     MAP STUDY--REGIONS OF THE WORLD
            40-178-3     MAP STUDY--LAND AND WATER
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e.g., 90 percent. An unanswered question is what this value should be. From need-achievement/fear of failure research, and other motivation research, it would seem this should be variable for different individuals.

As one would expect, PLAN POS's will vary considerably in type and amount of content covered, and in the rate and sequence in which that content is covered.

In conclusion it should be indicated that, regardless of the nature and degree of planning that has gone on, the teacher and student are the final authority in the classroom. They use the recommended POS as they see fit. They may implement the program of study in its entirety; they may make minor revisions to it; they may make major revisions to it; or they may even ignore it completely and develop an alternative program of studies for the student. Whatever their final course of action, however, they at least will have had the best counsel PLAN could offer.

The Role of the Computer in PLAN. The role of the computer in PLAN is quite different from the role of the computer in computer-assisted instruction (CAI). In the latter the computer operates a highly sophistocated teaching machine. In PLAN the computer serves in an adjunct capacity to the teacher. The computer provides the teacher with the extensive clerical support that is necessary in an individualized educational program.

The computer registers students, scores tests, advises the teacher every day of where the student is in his academic program, generates new suggested programs of study for students as the need arises, and when requested, sends messages to the teacher periodically so that she may plan her activities accordingly. For example, when several children reach the point at which a group discussion of some particular topic is called for, the computer tells the teacher that Johnny, Bill, and Mary are now ready for a group discussion of such and such a topic; or it may tell him/her that X number of children have all passed such and such a check point in their studies and that he/she might wish to plan a field trip to reinforce the material they have learned.

Every two months, or more frequently if the teacher requests it, a Student Progress Report is produced. It is a cumulative report of the student's work from the beginning of the school year. It shows: the modules the student has taken; the days he started and completed them; his test performance on the module; whether modules have been added or dropped; the relevance of the various modules to his long-range goals; the modules he has successfully challenged; the modules currently active, i.e., the modules he has started but not yet completed; and the modules yet to do for the remaining portion of the year.

This student progress report, then, constitutes not only the student's academic history, but also yields information regarding the student's habitual pattern of thoroughness in studying modules, his conservativeness in challenging modules, his characteristic work rate, and the like. The report is produced in multiple copies so that the student, his parents, and his teacher each receive a copy. This report constitutes, if you will, a module test version of a report card. It communicates a great deal more information than a report card, however; and it serves as a periodic heuristic for teacher-student interaction, counseling, and program planning.

The most frequent level of progress monitoring is the teacher's Daily Processing Report. This daily report, available for the teacher each morning before the start of school, notifies the teacher of, among other things, student progress on modules on which the student is currently active, that is, modules which he has started and not yet completed. The final section of that report also gives test results of all modules for which tests were taken in the previous day.

Finally, the computer also serves as a data bank for the development of instructional materials, the revision of tests, the requisition of supplies, and the like.

The Effectiveness of PLAN. The PLAN instructional system is now being used on a large scale experimental basis with approximately 40,000 students. A full scale system evaluation has not yet been completed. A series of local evaluations have been conducted, however, and during the period of PLAN development, extensive evaluation was undertaken with regard to the effectiveness of the instructional materials being developed. This was a regular ongoing activity resulting in periodic revision of the materials. In some instances, by the end of the developmental period, PLAN instructional materials were in their fourth generation of field testing.

The results of evaluation during the developmental period were highly encouraging. The purpose underlying PLAN was to individualize instruction, to make it more relevant to the needs of students, and to develop innovative classroom guidance procedures. Accelerated academic achievement was not the central purpose of PLAN, although some acceleration in academic achievement was expected, and obtained.

Based on assessment of both teacher behavior and pupil behavior PLAN appeared to be successful in many areas. Teachers in PLAN did indeed spend significantly more time in individualized instruction efforts than non-PLAN teachers. For example, in one study PLAN teachers were found to spend 20% more time in diagnostic and didactic inquiry with students, and approximately 35% more time devoted to work with individual students as compared to control teachers with similar sized classes in the same grades in the same schools (Quirk, et al, 1969). Similar results were obtained a year later by Steen and Lipe (1970). In a study of 220 PLAN classrooms and 89 control classrooms, Steen and Lipe found that PLAN teachers spent considerably more time in diagnostic inquiry and in small group and individual tutoring than teachers in control classrooms. Conversely, teachers in control classrooms spent considerably more time in large group lectures, content presentation, and information dispensation. These findings were corroborated still later in yet another study. Ellwood M. Johnston and Associates (1971) in a study of 12 New Jersey PLAN and 10 non-PLAN classrooms based on 320 hours of classroom observation found that PLAN teachers spent approximately 50% of their teaching time in one-to-one student assistance compared to 10% of their time in lecturing as compared to 30% for non-PLAN teachers. It was further found that non-PLAN teachers spent over three times as much time on clerical duties as did their PLAN counterparts.

Regarding pupil behavior, Lipe, Steen and Quirk (1969) found that PLAN students spent significantly more time than control students working alone on learning materials. But, they also spent more time than control students interacting with peers regarding learning relevant activities, and interacting with the teacher on an individual one-to-one basis. These results were replicated by Lipe and Steen (1970) a year later in a study of 267 PLAN classrooms.

Shanner (1971) found that the academic achievement of bright students increased materially over control students as a function of the length of time they were students in PLAN classrooms but that no differences were found between less able PLAN students due to the removal of ceiling effects for the bright PLAN students.

In one instance (Flanagan, 1970) a teacher wrote to the Director of PLAN that one of her students completed level six mathematics in the first few months of grade six, skipped to introductory algebra, completed that course before the end of the sixth grade and was working on second year algebra before the end of the school year. Upon moving to junior high school rather than continue a vertical sequence of mathematics study the student devoted his time to IBM correspondence courses in FORTRAN Programming and IBM 360 Computer Operation.

In another instance the vice principal of one of the PLAN schools wrote that he was of the opinion that PLAN students were "better behaved" than non-PLAN students and that in order to confirm his suspicions he had "tallied the number of times these students were sent to the principal's office for errant behavior." The average number of referrals per year per class for non-PLAN classes was considerably higher than that of the PLAN classes. The principal explained the difference as being due to the fact that in PLAN classrooms "students do not get bored" and "classroom management is simpler because the typical stress conditions do not exist." While this principal's reasoning as to the causes of his findings may be questioned, his findings of reduced classroom deviance have been corroborated by at least one empirical study. In the Ellwood M. Johnston and Associates study (1971) cited earlier, it was found that non-PLAN teachers spent four times as much time dealing with classroom discipline problems as do PLAN teachers. Whether this is because there are fewer discipline problems in PLAN classes, however, is not known.

Several studies have found that school absenteeism is less for PLAN students than non-PLAN students (Ellwood M. Johnston, 1971), 1/6 that of non-PLAN elementary school students (Rozran, Hicksville Public Schools, 1971). (In the Hicksville schools absenteeism increased with age for non-PLAN students, but decreased with age for PLAN students.)

Marvin Powell (1972) reported significantly higher Coopersmith Self-Esteem Inventory scores (see Coopersmith, 1967 and Sears, 1969) for PLAN students than for non-PLAN students, and Joseph LoGiudice (1970) reported sixth grade students who had been in PLAN three years to be significantly lower in test anxiety than non-PLAN students.

Finally, a number of studies suggest that, in general, PLAN students manifest higher academic achievement scores than non-PLAN students (Rozran, 1971 for Hicksville, New York), (Shanner, 1971 for Bethel Park, Pennsylvania), (Johnston, 1971 for Atlantic City, New Jersey).

While the evaluation of PLAN as a comprehensive instructional system is admittedly incomplete, and in many instances predicated on less than rigorously controlled scientific procedures, it was felt there was sufficient evidence to warrant large-scale system tryout.

The Relationship of PLAN and Individually Prescribed Instruction. The next project to be discussed will be Individually Prescribed Instruction (IPI). A number of similarities and differences may be noted. Both IPI and PLAN are examples of the systems approach applied to education. Both are predicated on the use of instructional objectives, a modular approach to curriculum definition, and tests to demonstrate academic mastery and to allow appropriate learner placement. They stem from different backgrounds, however. As will be seen, IPI derives from an interest in programmed instruction and an interest in trying to maximize the potential benefits to be gained from programmed instruction in a regular classroom. PLAN derives from Project TALENT and a concern for the attempting to make the educational experience of the child more relevant for him and more consistant with what will happen to him subsequent to his formal educational life.

Individually Prescribed Instruction

Individually Prescribed Instruction is an extension of the concept of programmed instruction for use in elementary school classrooms. It is being developed by the Learning Research and Development Center (LRDC) of the University of Pittsburgh and tested by Research for Better Schools, Inc., a non-profit Educational Laboratory funded initially by the U.S. Office of Education.

In 1961-62, Professor Robert Glaser, of the University of Pittsburgh, was experimenting with the use of programmed instruction materials in elementary school classrooms of the Baldwin-Whitehall school district of Pennsylvania. As a result of his efforts, it became obvious that it was difficult to fully utilize the individualizing capabilities of programmed instruction in a normally constituted classroom. Consequently, attention was directed to the question of how to modify classroom organization and structure in order to allow children to work independently at programmed instructional material at a rate which was most optimum for them.

During the school year 1963-64, preliminary efforts were undertaken to investigate the feasibility of creating an instructional system for an entire elementary school. These efforts received major support when the Learning and Development Center was created at the University of Pittsburgh through funding from the U.S. Office of Education.

In 1966, shortly after its inception under federal funds, the Research for Better Schools Laboratory undertook the responsibility of field testing the IPI system.

IPI is described as "an instructional system based on specific objectives, correlated with diagnostic tools, teaching materials, and methods. It represents one specific way of providing for wide ranges of differences that exist in classrooms." (Scanlon and Bolvin, 1970) After almost eight years of intensive research and development, the IPI elementary mathematics program was made available commercially. IPI reading, spelling, handwriting, and science are in various stages of development.

IPI's objectives are:

1. To permit student mastery of instructional content at individual rates;
2. To insure active student involvement in the learning process;
3. To encourage student involvement in learning through self-directed and self-initiated activities;
4. To provide student evaluation of progress through mastery;
5. To provide instructional material and techniques based on individual needs and styles (Scanlon and Brown, 1971).

In brief the IPI curriculum developers identified 363 behavioral objectives which they felt adequately specified the domain of skills essential for a comprehensive elementary school mathematics curriculum. These objectives were then sequenced in the order essential for optimum student progress. Instructional materials were then developed which permitted the student to gain mastery of these objectives. Then 363 objectives were incorporated into 65 instructional units which comprise the grade 1-6 program. Of course, the objectives, their sequencing, and the instructional materials were the result of many cycles of development and tryout.

The system operates as follows. Upon entry to the IPI system, the student is given an arithmetic achievement placement test to identify his general level of functional ability vis-a-vis the requisite skills of the IPI program. The purpose of the placement instrument is to provide "a gross picture of each student's mastery of each unit of work along the learning continuum."

After his general placement has been ascertained, but prior to actually starting work on the assigned unit, the student is given a unit pre-test. If the student demonstrates 85% or better mastery of each skill on the pre-test, he would advance to the next unit. If not, his teacher would develop a prescription for the study of those aspects of the unit which he had not yet mastered. For the most part the child would work independently (Scanlon and Brown, 1971).

In developing the prescription, the teacher would consider the materials available, the techniques of instruction possible for this objective, and the student's characteristics as they relate to instruction. These characteristics might include his reading ability, his capacity for self-direction and independence, his age or grade placement, and his past reaction to particular learning materials. "An important characteristic of the prescription (is) that each assignment (is) based on what a particular student (can) accomplish in a class period, and it is reviewed on a daily basis" (page 100).

The instructional units typically include a curriculum embedded test after the activities for each specific learning objective so that the student can immediately assess his own performance on the objective just studied. Upon completion of the instructional unit, the student takes a post-test. If he demonstrates mastery, defined as a score of 85% or more, on all of the objectives, he is then assigned the next unit on the instruction continuum. If his post-test score is less than 85%, he re-studies the unit until such time as he can pass the post-test.

As might be expected, the IPI system requires an extensive amount of effort in work correction, test scoring, data recording, student progress monitoring, and the like. "To free the teacher for tutoring and evaluating student progress, materials, and tests were scored by a teacher aide, or by the student" (Scanlon and Brown, 1971, page 100). Without the substantial services of classroom teaching aids, IPI would be impossible to operate.

IPI represents a most impressive step forward in the application of programmed instruction techniques, on a large-scale effort, to regular classroom instructional procedures. To accomplish this, LRDC had to develop new instructional materials and field test them, develop diagnostic procedures to ascertain the student's skill repertoire on entry, develop procedures to assess skill attainment subsequent to studying the instructional materials, reorganize the school classroom to accommodate independent study, provide the teacher with a new form of clerical resource with which to manage the system, and provide teacher training to prepare teachers to use this new instructional format.

While IPI provides for individual differences in rate of progress through the material and for individual differences in the instructional activities the teacher might assign to the student, it typically provides very little individualization in what a child studies, i.e., content, and the sequence in which he studies it. Project PLAN, on the other hand, was an effort to develop a somewhat more comprehensive instructional system. It spanned a broader grade range (grades 1 through 12), attempted to articulate study programs across subject matter areas, introduced new guidance procedures, including vocation information, study skills, and career guidance, and more importantly, individualized the content the student was to study.

The last system to be discussed resides somewhere between IPI and Project PLAN. Like IPI, it derives from a background of programmed instruction, and the attempt to use it on a large scale for regular classroom instruction, but like PLAN it became increasingly concerned with providing students options in their approach to the content.

The Oakland Community College System

Oakland Community College, a college of 15,000 students, opened in 1965 to serve one of the northwestern suburbs of Detroit, Michigan. From the beginning the board of Trustees was committed to the creation of a new form of community college instruction. Under the direction of its first president considerable work was done to create physical facilities, hire faculty and develop an instructional program. A commitment was made to the use of a programmed instruction format. With the early assistance of Lytton Industries, the college faculty identified terminal objectives for each of their courses and instructional materials were developed. Courses were comprised of a series of self-contained instructional units requiring roughly 10 to 20 hours of study time, i.e., one to two weeks of normal college study time.

At the beginning of each unit, the student was presented with a list of the five or so objectives he was to master by the end of the unit; an assignment sheet listing the instructional materials to use and the assignments in those instructional materials; exercise sheets; problems; and the like. The student was free to schedule his work to his own convenience.

Each discipline area, such as psychology, economics, etc. had its own instructional resources and study carrels which were manned 14 hours a day. Instruction was typically via programmed textbooks and audio tapes. During the early days, the student drop-out rate was exceptionally high. It is now felt that one of the reasons for the drop-out rate being so high was that inadequate attention was given to individualizing the methods and materials of instruction. Attention had been focused primarily on the mechanics of materials development and monitoring. Only little attention had been given to the learner component of the system. In retrospect it is easy to see how a student, educated in traditional classroom practices, might have difficulty on entering a college program predicated entirely upon independent reading, limited audio-tape inputs, and exclusive reliance on self pacing. The problem encountered was not unlike those that eventually resulted in the development of the IPI system, and precisely the problem noted by Skinner a decade earlier in the use of the programmed materials to teach an introductory psychology course at Harvard.

When Dr. Joseph E. Hill assumed the presidency, he vastly increased the instructional alternatives open to students. He and Dr. Derek N. Nunney, Vice-President, embarked upon one of the most comprehensive efforts at matching the student to optimum instructional methods yet attempted. The crux of their procedure for personalizing educational programs revolves around what they call cognitive mapping. When a student enters a program he undergoes a three-hour battery of individual diagnostic tests. Some measure ability at abstract reasoning, others measure visual and manual coordination, others measure levels of developed abilities in reading and mathematics, others measure interest and preferences. In brief, the tests yield a total of 26 binary scores in four basic areas. The first set of scores represents the ability of the individual to deal with theoretical symbolic operations in areas such as verbal aptitude, intelligence, reading, and mathematics skills. The second set reflects the individual's ability to deal with qualitative symbolic orientations and is based on the individual's ability to assimilate information via various sensory modalities and to operate on empathetic, ethic levels, motor skills, etc. The third set reflects the individual's preference for learning in various types of social settings, such as individually, with associates, or in a family-authority setting. Lastly, the fourth set reflects inference modalities preferred by the individual, that is, whether he attends primarily to relationships, to differences, to absolute or to categorical thinking processes.

These test results constitute a "cognitive style map." This cognitive map is then used in the development of a student prescription for learning. Based on his cognitive style map, the student may be referred to one or more of seven different alternative instructional methods. If the student is weak in basic skills he may be advised to study in the Individual Programmed Learning Laboratory where he improves his basic academic skills with programmed instruction materials and faculty assistance. He may be assigned to the Carrel Arcade, the heart of the instructional effort, where he may view movies, listen to audio tapes, use video records, receive tutoring from para-professional faculty, and the like. On the other hand, if the student cognitive map suggests that he might learn best in small group peer interaction, he may be assigned to study in a one-to-one relationship with a peer tutor. If the student learns best by reading he may be directed to the Learning Resources Center where he would find library books, periodicals, microfilms, research materials, and the opportunity to work independently. The fifth and sixth instructional options are seminar options, one a series of formal seminars with faculty, the other a series of informal student-led rap session seminars. The seventh option is true independent study where the student is free to pursue mastery of the unit objectives in any way he chooses.

The options then really break down as follows: 1. he may be assigned to programmed instructional material where he has faculty assistance as needed; 2. he might be assigned to the Carrel Arcade where he has access to a wide variety of audio-visual materials; 3. he may receive tutoring, either from para-professional staff or from a peer tutor who is paid by the college; 4. he may accomplish his work through traditional library resources; 5. he may attend seminars, either formal or informal; or 6. he may be completely independent.

After completion of his instructional unit, the student takes an examination to see if he passed. If he does, he goes on to the next unit in the sequence; if not, he reviews those objectives he failed or re-studies the course as necessary until he can pass the module test.

At present the personalized educational program has been implemented in only a few courses, but the results are striking. As of the end of the academic year 1970, over 10,000 students had been tested in the Diagnostic Testing Center and had cognitive style maps developed for them. In the Foundations for Modern Society Course, the basic social science course of the college, the annual failure rate has dropped from 38% to less than 7%, and by the end of the semester more than 93% of the students had attained a grade of "C" or better.

The Foundations course was comprised of seven two-week units. The course offered three different instructional options for the first day of class, seven options for the second day, and six options for the third day of class meeting each week. In this way instructor presentations, student study, class exercises, and the like could be accommodated. This set of options resulted in 126 different theoretical combinations that a student might select, or be assigned to follow, in taking the course.

Summary Comments

What Generalities Can Be Drawn From The Various Systems Efforts? First, they all tend to require a fairly extensive amount of instructional material, and, collaterally, probably a higher than average rate of materials consumption and lower classroom equipment life. Classes also tend to be marked by a fairly high degree of student activity, and because of that a fairly high classroom noise level, and a minimal role for teachers as information dispensers. They also tend to be marked with a higher incidence of ancillary people, team teaching, open space arrangements, and the like. Whether or not this is necessarily inherent in individualization is not the question. School systems progressive enough to experiment with new forms of instruction to maximize individualization are also more likely to experiment in other areas as well.

Also, it is probably safe to generalize that administration will encounter some teacher problems. Some teachers may, by virtue of their own personal needs structure, derive a high measure of gratification from being a substantive expert and a person of some authority in the classroom. It is quite likely that radically different personality needs will be gratified by a thoroughly individualized education program.

It is also reasonable to assume that there may be individual differences in the degree in which students can adjust to various forms of individualized education. It can be intuited that older children would have more difficulty adjusting to individualized instruction than younger students by virtue of the fact that the former have spent a relatively larger portion of their educational lives learning how to beat one type of system only to find themselves thrust, abruptly, into an entirely different system.

Finally, most individualized education programs lay some claim to placing more responsibility on the student for self-management of his own progress through the program than does the more traditional method.

These generalizations are, of course, just that and should not be taken as laws or principles. For every generalization made there are many instances where the converse might be true for a particular type of installation or program.

PART II - REQUIREMENTS FOR COMPREHENSIVE INDIVIDUALIZATION IN CAREER EDUCATION

As was discussed in Part I of this report, individualization has been variously defined. It has ranged from fairly narrow and circumscribed definitions to fairly extensive and comprehensive definitions. Comprehensive definitions require that instructional content and method be purposefully varied as well as rate and setting.

The development of a comprehensive procedure for the individualization of education involves consideration of at least four classes of factors:

1) family - personal factors,
2) instructional systems factors,
3) data access factors, and
4) decision rule factors.

Family/personal factors primarily involve the identification of the long-range goals and aspirations of the students to be served by the educational system. This is not, however, simple goals specification. It involves at least three steps:

1) the objective assessment of one's interests, values, and abilities;
2) the identification of long-range goals or aspirations which are judged to be "realistic" in terms of an individual's self-assessment; and
3) the development of rational plans for goal attainment.

Involved in these three steps is not only the deliberation of the individual student himself, but also inputs deriving from the fact that the student is part of a social family context. Thus, parental aspirations and values also play a role in student goal formulation especially inasmuch as the student is not, legally, a free agent in society. Chapter 4 deals with student goal formulation.

Once a student's short- and long-range goals have been identified and become the focal point for the development for his individual educational program, it then becomes necessary to consider the resources available to him via the instructional system. This requires a thorough analysis of the curricular options open to the student, the structure in which those options can be realistically organized, especially in view of the sequential and often hierarchical nature of some basic academic development (e.g., the development of analytical skills and mathematics), and finally, the options open within the instructional system for the presentation, management, and assessment of learning experiences by means of which student goals are to be obtained. These considerations are discussed in Chapter 5.

The third main cluster of factors to consider are data access factors. Given realistically established goals and an instructional system with a potential for assisting the student to realize those goals, attention next needs to be directed to the mechanism whereby students can be afforded the opportunities inherent in the instructional system at their disposal. This involves: 1) data access considerations and 2) procedures whereby individualized educational programs can be developed accordingly. These considerations are discussed in Chapters 6 and 7.

In order to be effective, then, a comprehensive empirically-oriented system for the individualization of education must have the following attributes:

1) a broad array of educational objectives and extensive alternative content whereby those objectives may be mastered;
2) a variety of instructional procedures, settings, and contexts, i.e., instructional activities, in which the content of the instructional material may be mastered;
3) an extensive cross-indexing of these curricular objectives, materials, methods, and learning contexts;
4) an extensive data base regarding the individual students's interests, abilities, aspirations, optimum learning styles, long-range goals, ambitions, etc.;

5) an extensive cumulative record on each student regarding his past academic accomplishments and academic records; and finally,
6) a procedure for coordinating this information and the specification of individual study programs. In this process the constraints imposed upon the planning for and by the student, resulting from parental wishes, state and local legal requirements, and the restrictions imposed upon the system by virtue of supply, logistics, and administrative practice must also be considered.

In brief, there must be an interfacing of the opportunities afforded by: the instructional system including the teacher and the activities she assigns; the individual and his needs, interests, and accomplishments; the instructional materials and resources available for use; and the interests of the student's parents, and of his society.

To arrive at the fullest utilization of available information regarding individual differences, some extensive data processing system will be required. Human decision makers, of course, should play the final role in such a system. However, their role would be advanced, and the efficiency of their decision making would be facilitated through the use of backup technology such as high-speed digital computers. Indeed, it is through the use of sophisticated educational technology that maximum advances can be made in the individualization of education. One of the basic theses in Toffler's book Future Shock (1970) is that the mass production of highly similar standardized units is a characteristic of only primitive technologies; that with increasing technological sophistication comes increasing capability for the individualization of the product.

There are of course many difficulties to implementing effective programs for the individualization. The need for large amounts of information about the individual learner and some means for tracking his performance and digesting information about the learner preparatory to instructional decision making has already been mentioned.

Similarly, the need for an extensive instructional resources base to accommodate the broad range of student interests and needs has also been commented on. The relative sparsity of solid data regarding effective methods of identifying the student's optimum learning style and how to cater to it has also been touched, albeit briefly.

Perhaps the biggest obstacle to individualizating education, however, is the problem of content selection, and its related problem content sequencing. The former is, at present, primarily a value question. The truth of the matter is we don't really know what is important to know. There is no definitive answer to what content is essential for what end.

Finally, a truly individualized educational system must not be such a rigid system that a student cannot easily modify his program in the light of changes of interests, goals, or objectives.

Reduced to its simplest terms, the following are needed:

1) a cross-indexed set of instructional resources;
2) the identification of the individual student's long-range goals;
3) a bank of data with regard to the individual, his interests and abilities;
4) a specification of state and local school system requirements, i.e., legal requirements;
5) an information system to provide for the confluence of these data; and
6) a set of decision rules whereby educational planning can be effected.

CHAPTER 4

STUDENT GOAL FORMULATION

Two of the objectives often ascribed to individualized education are: 1) to assist the student to determine what he wants to be, or become; and 2) to help him attain the goals that he has set for himself.

There are two basic requirements for the attainment of these objectives: 1) the student must have access to reliable information, both about himself and about options that are open to him (such as jobs, school, life styles, and so forth; and 2) he must be able to use that information in forming long-range as well as short-range goals and in deciding on actions to help realize these goals. The latter area, assisting students to consider what they want their lives to be and to realize those goals, is the topic of this chapter of the report. (For the purposes of this study, "decision making" is viewed as the process of identification and evaluation of alternative courses of action to achieve a specified goal and the selection of a "best" alternative.)

Specifically, this chapter discusses goal formulation as it relates to Career Education, reviews selected types of programs currently in use that relate to student goal formulation, and proposes alternative models for goal formulation programs within Career Education that would allow for the individualization of education as described above.

Conceptions of the Term "Goal"

Traditionally the term "goal" has been defined rather narrowly. When educators spoke of students' goals they usually referred to their educational goals (whether or not they wanted to go to college) or to their specific vocational goals (whether they wanted to be a doctor, secretary, engineer, or teacher). It was expected that once students had determined their goals, they would then take steps to achieve them.

In the past few years, however, broader conceptualizations of the term "goal" have been proposed. Many guidance programs (see the following section "Current Programs for Career Goal Formulation") ask students to consider broad career categories, such as occupations in the physical sciences rather than specific jobs, in formulating their goals.

In AIR's Career Guidance System, six different areas of goal formulation are proposed: vocational, educational, personal-social, academic-learning, citizenship, and leisure. Students are asked to consider their goals or aspirations for each of these facets of their lives. In describing the role of guidance in individualizing education, Flanagan (1970) discusses the formulation of life goals by students, based on their interests and values, as well as their abilities.

Katz (1969c) expresses a similar view in his definition of one function of guidance services as assisting students to determine "What do I want to become?"

Thus, there seems to be a trend now toward assisting students to consider their lives as a whole and to consider what they would like in all areas of life, rather than simply what kind of job they would like. In addition, there is a tendency to see goal formulation as a periodically recurring process wherein an individual continuously reviews and, when necessary, modifies his goals.

Another contemporary factor which should be considered is the attitude of many students that formulating long-range goals and planning for the future are irrelevant in the light of the problems currently besetting society. The "Now" ethic would seem to preclude both the establishment of goals and the consideration of procedures to realize such goals.

In discussing issues relevant to decision making and self-processes at the recent Conference on Systems under Construction for Career Education and Development, David Winefordner asserted that students tend to see their inter- and intrapersonal needs as more important than educational or vocational needs; the latter, they feel, are the needs most valued by society. While these attitudes may not be held by a majority of students today, they are indicative of the thoughts of many of the students which Career Education will be attempting to reach. For this reason, it is important to consider how to deal with these attitudes in providing any kind of program in goal formulation.

We will interpret "goals", then, as being "life goals" -- one's aspirations for what he wants his life to be like, now as well as in the future. The various areas of goal formulation, such as personal, social, vocational, avocational, and leisure, will be viewed as together comprising composite life goals.

It should be noted that goals are not necessarily attained only in the future; many of an individual's life goals may be immediately or nearly immediately realizable. Thus, goal formulation is not a process by which one precisely maps out one's future but rather a process of determining what you want your life to be, now as well as in the future. Moreover, inasmuch as goal formulation is a process, not a unitary event, goals are flexible rather than fixed. The aspirations a student has now for his life may or may not be consistent with his interests and values in a few years. Periodic reassessment of one's self and reevaluation of one's goals should be an integral aspect of goal formulation.

Perhaps a distinction should be drawn at this point between the terms "goal" and "objective." Goals refer to some general skill or condition one would like to acquire or attain. Objectives, on the other hand, are statements of a very specific skill or activity and are ideally expressed in behavioral or performance terms. One might identify several objectives which, if met, would enable one to realize his goal.

Components of Goal Formulation

There are three basic processes that should be involved in personal goal formulation. First, the student should assess his present status of development, i.e., determine his present level of development. Second, he should identify his aspirations, i.e., what he would like his life to be. Third, given understanding of his current interests, abilities and values, he should decide what activities he needs to engage in which would help him realize his ambitions.

This analysis of the process of formulating one's goals is not intended to suggest that a program designed for students' use should be a mechanistic process whereby one completes a series of steps to arrive automatically at the formulation of goals. The student must also be aware of the subjective factors in goal formulation as well. It is essential that the student perceive the process as a central aspect of self-actualization.

Self-assessment. In this phase of effective goal formulation, the student is asked to focus on himself, to consider his abilities, interests, values, attitudes, and so forth. He is asked to examine and consider a large and varied store of objective information about himself. This information may include test data relating to his abilities, and possibly his interests and values as well.

In addition, he may also be asked to consider subjective information, such as information about his strengths and weaknesses, his attitudes and opinions, and so forth. This information may be acquired through teacher or supervisor observations, through structured situation tests, through peer feedback (such as in sensitivity groups), or through self-awareness, self-examination. While this process of self-assessment may suggest some goals to the student, its primary function is to give the student a good picture of himself against which he can evaluate potential goals or courses of action.

Identifying aspirations. After determining "where he's at," the next step for the student is to determine where he wants to go, i.e., what he wants his life to become. The student needs to consider his aspirations with regard to each of the following areas.

1) Educational goals -- what education, if any, beyond high school is planned? What particular subjects, if any, will be studied?
2) Vocational goals -- what kinds of occupations or jobs might be sought?

3) Avocational goals -- what kinds of extra-work skills or hobbies might be developed? What kinds of citizenship activity are planned? What type of military service, if any, is planned?

4) Personal/social goals -- what type of life style is desired? What kinds of leisure time activity will be engaged in? What personal attributes or skills need to be developed? What interpersonal skills need to be developed?

Each of these areas, of course, cannot be considered separately; they are all interrelated. Decisions about desired life style will have implications for occupational plans; decisions about occupational goals will have implications for educational plans.

To formulate his goals, a student needs to have information about the different options that are available to him. This is particularly true with regard to the setting of occupational goals. In society today there is a high degree of geographical, social, and occupational mobility. Thus, students should be aware of the wide variety of alternatives that exist. Moreover, it is important to insure that the student actually receives this information. If it is simply made available to students, it is unlikely they will make full use of it. Initial experience with the computerized guidance system being developed by the Appalachia Educational Laboratory has shown that with information on a variety of occupations available, students tend to request information for those jobs which they have already decided upon, rather than using the system to find out about other jobs they may not have considered (Winefordner, Conference on Systems under Construction for Career Guidance and Development, 1971).

In particular, the following kinds of information should be presented to students: 1) information about a variety of occupations; 2) information about different educational opportunities; 3) information about military and non-military methods of fulfilling the military service obligation; 4) information about procedures for acquiring special skills or developing hobbies; 5) information about various citizenship activities, including activities that students under age 18 can engage in; 6) information about various life styles;

7) information about various leisure time activities; and 8) information about procedures for attaining specific goals, such as school or job application skills.

In formulating their goals, students should be encouraged to consider the implications and consequences of their various goals. In particular, they should learn to recognize where conflicts between different goals exist, where achieving one goal will preclude the attainment of another. In addition, they should examine the immediate consequences of a particular goal -- what it will take to achieve that goal. For example, if a student is considering becoming a doctor, he should also consider the amount of schooling required to achieve this goal. If he wants his life to be crafts-oriented, he must both know about a variety of crafts he could engage in and also possess or obtain the skills necessary to carry out this activity. In general, students should be encouraged to formulate their goals such that a maximum number of satisfactory options are kept open for them.

Data from the five-year follow up of Project TALENT students showed an overall occupational choice stability rate of 27.9%; in other words, 27.9% of those students selecting a particular occupational goal in twelfth grade held the same goal five years later (Flanagan, 1971). With such a high rate of change in goals, it is important for students to maintain maximum flexibility in their planning.

Determining appropriate procedures for realizing goals. In addition to formulating their short- and long-range goals, students should be able to identify activities through which they can realize their goals. There are three basic areas in which Career Education can help students act to help realize their goals: educational planning, vocational exploration, and personal development.

With regard to educational planning, students should attempt to identify what educational activities will best help them realize their goals. Obviously, this includes identifying courses and instructional activites in which they should enroll. Students should consider both academic activities, such as taking sufficient mathematics or science to qualify for a particular job or college, and non-academic educational activities, such as classes to develop one's skills in art or woodworking. In addition, students should be prepared in skills necessary for applying to any special educational or training programs. This should include actual practice in interviewing and completing application forms as well as just learning about the skills required.

Vocational exploration activity represents a major step towards realizing one's vocational goals by assisting students to actually sample the kinds of work they are considering for their vocations. In addition, it provides an opportunity to see how their avocational and personal/social goals relate to the type of vocations they are considering. Students should be assisted to identify opportunities for actually doing work in areas related to their vocational goals -- both work-study positions within the educational framework and part-time outside or summer jobs. In addition, as was true for educational planning activities, the students should be given practice in the skills involved in looking for and applying for work positions.

Activities for helping students to realize their personal goals may be the least familiar to students. It is often difficult to determine what personal development activities will be most useful in helping one achieve one's goals, much less determine how to find and engage in such activities. Students should be taught about a variety of resources for assistance in personal development. Counseling and guidance services will be an important source, but community-sponsored sensitivity groups, role-playing workshops, relevant books, and other similar activities should also be included.

In all these areas emphasis should be given to the role one's daily activities can play in helping a student to realize his goals, to make his life the way he wants it to be. For example, a student's goals may not include spending two (or four, or six) hours a day in class when he could instead be working. However, he should be taught to see how his classwork will help him get and do the kind of job he wants.

Underlying need for skills in decision making. The entire process of formulating short- and long-range goals requires that students be able to identify alternatives, evaluate them, and select those which seem most congruent with their interests, values, and abilities. Thus, as part of the goal formulation program, the students should receive training in skills of decision making.

The distinction drawn by Katz (1969b) between "making wise decisions" and "making decisions wisely" is relevant here. It should not be the intent of Career Education to teach students to decide on certain outcomes, such as attending college, but rather to teach them how to go about making decisions; the appropriateness of a particular decision for a particular student can only be judged in terms of that student's characteristics and can probably best be judged by that student himself. It may be that a student wishes to adopt a goal which, it seems to others, he has little likelihood of realizing. It is suggested that if the student has considered his decision and still wishes to take the risk, he should be allowed that choice. Thus, the emphasis of the goal formulation program will need to be on assisting students to understand the decision-making process and to incorporate this process in their own decision making. In giving them the opportunity to make their own decisions, they are also given the responsibility for those decisions and for the consequences of those decisions. It is only by allowing students a fairly large degree of risk that they can experience the importance of considering their decisions carefully.

Expected Outcomes of Goal Formulation Program

The immediate outcome of this program should be that the student is able to formulate realistic educational, vocational, avocational, and personal/social goals and to identify actions they can take that will facilitate the attainment of those goals. (By realistic goals, we mean goals that the student could attain, were he to take the proper steps. Mutually exclusive goals would not be considered realistic.)

As a longer-term consequence, it is also expected that the skills the student develops in self-assessment, goal formulation, and decision making will generalize, so that the student is continually able to develop reasonable expectations about himself and his life, and is able to take steps to realize these expectations, even after he "graduates."

Interface with Other Components

There are two basic ways in which the goal formulation program may interface with other aspects of Career Education. First, there may be a functional relationship, whereby some of the objectives of one area may be met by activities conducted in another. Second, there may be a technical relationship, wherein the structure of one area influences the structure of another. Specific areas of interface of each of these types are described below.

Functional interface. It is expected that there will be functional interface between student goal formulation and five other areas: guidance and counseling, work-experience coordination, data collection, intended outcomes and content, and individualization of educational programs. The nature of this relationship is likely to be interactive, so that decisions and experiences in one area will influence, and be influenced by, decisions and experiences in the other areas.

Specific descriptions of the relationship between goal formulation and these areas are:

1) Counseling and Guidance -- student self-assessment activities will be conducted through the counseling and guidance services; similarly, assisting students to identify appropriate activities for personal and social development will often be handled through this program.

2) Work-Experience Coordination -- the work-experience program should provide the student information about work in general and about specific occupations which he can consider in formulating his goals; it should also provide information about how the student functions in the work situation which will be useful in the self-assessment phase; finally, decisions the student makes about this work-study experience are likely to be determined by the goals he sets.

3) Data Requirements -- much of the data that is collected about students will be used by them in the self-assessment phase of goal formulation. Thus, these data should be readily available, in a form which students can understand.

4) Intended Outcomes and Content -- much of the information that the students will need to consider in formulating their goals, such as information about occupations or educational opportunities, will be presented through the students' curricula. Similarly, much of the information they will need for identifying appropriate procedures for attaining their goals, such as information about school and job application skills, will be presented through the curricula.

5) Individualization of Educational Programs -- the students' study programs should, insofar as possible, reflect their goals and also their plans for attaining their goals.

Technical interface. There are three areas in Career Education which have a technical relationship to the goal formulation program. First, the staffing requirements of the various goal formulation models will have implications for the overall project staffing. Second, the information system should allow for easy access to information by the student and for the input of student goals and decisions to other, relevant areas such as the counseling and guidance services. Third, consideration will have to be given to the roles various stakeholders, such as parents and guardians, will play in students' goal formulation.

Relation of Goal Formulation Program to Career Education

"Career" in Career Education is defined as "life"; as such, the function of Career Education is to prepare students for life. The concept of goal adopted in the goal formulation program is consistent with this definition in that attention is given to assisting students to formulate their goals for all aspects of their life -- avocational, personal, and social as well as educational and vocational. Moreover, insofar as a student's program of studies is related to the goals he expresses, the student's educational program will be truly individualized. In addition, by assigning learning experiences that relate to a student's goals, not only will the student's learning occur in a functional context, but also in one that is maximally relevant to his needs.

There are, however, certain questions which should be carefully considered in designing a program for goal formulation in Career Education. First, how much consideration should be given to the opinions of "stakeholders" in students' goal formulation and, conversely, how much freedom should students have to formulate goals for themselves. It is suggested that the primary responsibility for goal formulation should rest with the students, for if an individualized program is to be effective, it must be based on goals that the student sees as relevant and meaningful. Moreover, if a student is responsible for determining and achieving his goals, he is more likely to become interested and involved in his educational program. Finally, by giving the student this responsibility the student will learn that even in school he can play an active role in shaping his life, reinforcing the concept of a "sense of agency." However, students should be encouraged to consult with parents, guardians, and other appropriate persons in their formulation of their goals.

A second important question relates to the attitudes of students toward the formulation of goals: should students be allowed to reject planning and goal formulation, adopting a passive, "live for the moment" philosophy if they choose? It is hoped that the efforts of Career Education to develop a sense of power or agency over their lives in the students will allay this feeling. The direct relationship between student-expressed goals and students' educational programs should encourage students to take an interest in goal formulation.

Also, with the existential concept of goal as "what you want life to be," rather than "what job you want," it is likely that much of the resistance to goal formulation as a mechanistic process will dissipate. However, if some students elect not to make their life-goals explicit, consideration should be given to permitting this course of action so that the responsibility for their educational program continues to rest with them.

Finally, questions have been raised about the emphasis on rational, scientific decision-making processes contained in most of the decision-making and goal-formulation programs currently being developed (Bolling, Conference on Systems under Construction for Career Guidance and Development, 1971). Stress should be given to the role of emotional and physical factors in decision making, even though these may not be observable, measurable, or predictable phenomena. Students should also be encouraged to consider their values and attitudes, as well as their abilities, in making decisions and formulating goals.

Current Programs for Career Goal Formulation

With the increased emphasis now being placed upon the importance of early career planning, students across the nation are being offered a variety of techniques which assist them in formulating career goals and developing decision-making ability. Some of these guidance systems are computer-based, others employ more traditional methods of imparting information, but in all cases the intention is the same: help the student start thinking about his career and career preparation in better informed and more realistic terms than has traditionally been the case. Typically, three steps are involved: supply data about a variety of vocations, teach the techniques of prudent decision making, and encourage the tailoring of current academic programs toward vocational interests. Descriptions of a selected sample of career guidance systems currently being used are given below. Many others are also available. Fifteen exemplary programs are soon to be selected from a pool of 30 outstanding programs and described under the auspices of BAVTE (OE RFP 72-42).

Sample Computer-Based Goal Formulation Programs

Many of the programs designed to assist students in decision making and goal formulation rely upon computers for storing information about students and educational or vocational options, and providing immediate access to this information to students and counselors. See for instance *Career Education and the Technology of Career Development: Proceedings of the Eighth Invitational Conference on Systems under Construction in Career Education and Development* (Tiedeman, 1972).

The Harvard-NEEDS-Newton Information System for Vocational Decisions (ISVD). The Information System for Vocational Decisions was developed under the direction of D. V. Tiedeman. It is a computerized guidance system with the flexibility to provide the student with a complete, ideal, decision-making environment. The computer provides information on career options, computer-assisted instructional units in career decision making, and supervised practice in decision making under computer-monitored conditions. The objectives of this system are to assist the student to understand the decision-makiing process, to have accurate knowledge of alternatives and their consequences, to have an understanding of his personal characteristics, and to develop a sense of functioning or of being a determining agent in the course of one's own career. The student, in interacting with the data presented by the computer, is taught decision-making skills and attitudes (Tiedeman, 1968).

The AIR PLAN Guidance system. The AIR PLAN Guidance system is a comprehensive guidance system incorporating vocational information, study skills, and military, college and post-high school counseling as well as personal and social development, long-range goal (LRG) formulation and the generation of individualized study program recommendations. Figure 4-1 presents a list of units in the PLAN Guidance program.

Three of the assumptions underlying the AIR guidance commitment are:

a. schools should make a much more direct and concerted effort toward considering, and accommodating, parental wishes and aspirations for their children;

b. guidance, in an individualized education system, must be concerned not only with helping students to formulate and pursue long-range educational and vocational goals, but also with making the educational system responsive to the needs, interests, and abilities of students; and finally,

c. a guidance program, to be effective, must be predicated on empirical evidence.

The student goal formulation component of the comprehensive system consists of 37 documents and booklets of various types and required the equivalent of 25-35 weeks of study (i.e., the equivalent of 60-75% of a full academic year of study). The paradigm being followed is given in Figure 4-2. The program results in the student and his parents jointly arriving at, and specifying, the

FIGURE 4-1

Units in the PLAN Guidance Program

Career and Vocational Information Modules

40-058	Consumers and Producers
40-059	Wishing and Choosing
40-060	Neighborhood Helpers
40-061	Transportation
40-102	Small-Town Neighborhoods
40-110	Schools in the Neighborhood
40-113	TV Programs
40-119	People in the Neighborhood
40-151	What is a Community?
40-163	Mountain Communities 1
40-164	Mountain Communities 2
40-167	Grassland Communities 2
40-169	A Planned Community
40-208	Searching for Information
40-211	A Modern View of Your State
49-350	Introduction to the World of Work
49-351	The Variety of Jobs
49-353	Business Sales Occupations
49-354	Mathematical and Physical Science Occupations
49-355	Mechanic and Repairman Occupations
49-356	Health Service Occupations
49-357	Industrial Trades Occupations
49-358	Business Management Occupations 1
49-359	Business Management Occupations 2
49-360	Teaching Occupations
49-361	Public and Commercial Service Occupations 1
49-362	Public and Commercial Service Occupations 2
49-750	Introduction to the World of Work
49-751	The Variety of Jobs
49-752	Preparing for Career Decisions
49-753	Technical Occupations 1
49-754	Technical Occupations 2
49-755	Engineering and Architecture Occupations
49-756	Biological Science Occupations
49-757	Social Service Occupations
49-758	Business-Clerical Occupations 1
49-759	Business-Clerical Occupations 2
49-760	Building Trades Occupations
49-761	Social Science Occupations
49-762	Performing Arts Occupations

Orientation and Study Skills Modules

89-301	PLAN: Orientation
89-302	PLAN Program of Studies
89-701	PLAN Orientation
89-702	PLAN Program of Studies
19-301	Strategies for Test-Taking
19-302	Study Skills
39-301	Individual Differences and Their Measurement
39-701	Individual Differences and Their Measurement
19-701	Strategies for Test-Taking
19-702	Study Skills
19-703	Listening Skills

Student Goal Formulation Modules

89-703	Choices and Consequences
89-704	Introduction to Decision Making
89-705	Job Families and Jobs: Introduction
89-706	Job Families and Jobs: Part I
89-707	Job Families and Jobs: Part II
89-708	Job Families and Jobs: Part III
89-709	Job Families and Jobs: Part IV
89-710	Career Planning Practice I
89-711	Career Planning Practice II
89-712	Interests and Values in Career Decision Planning
89-714	Student-Parent Evaluation of Long Range Goals

Military, College and Post-High School Counseling Modules

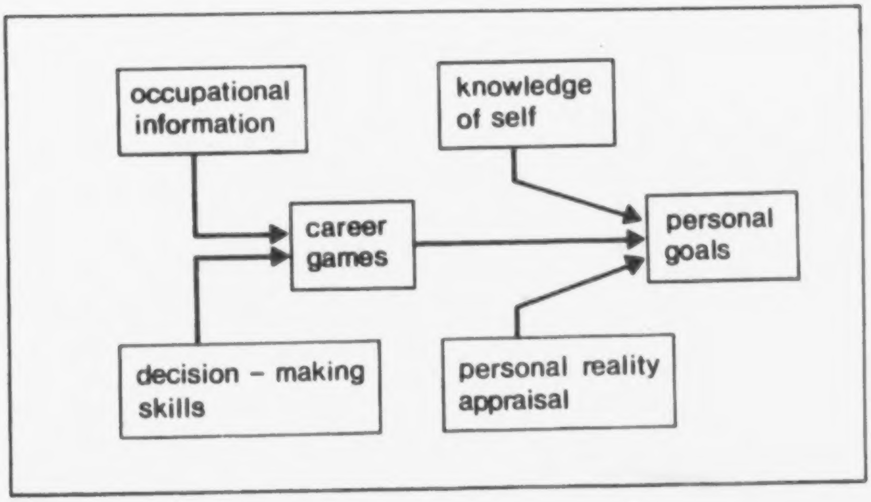
19-704	After High School, What?
19-705	Information About Colleges
19-707	Draft and Military Information
19-556	Speech--Job Opportunities
19-708	Application Skills
15-402	Preparing for Leaving High School: Application Skills
85-003	Preparing to Leave High School: Interviewing Skills
85-004	Part-Time Job Application Skills
85-005	Leisure Time Activities I: School Related
85-006	Leisure Time Activities II: Non-School Related
85-007	Citizenship Activities I: Political Involvement
85-008	Citizenship Activities II: Community Involvement
85-009	Citizenship Activities III: Making Your Views Heard

Student Assessment Devices

Kindergarten Reading Readiness Form
Introductory Reading Placement Tests
End 4 Module Tests
PLAN Achievement Survey Tests
Developed Abilities Performance Tests
General Information Test
PLAN Interest Inventory
Student Learning Style Rating Scale
Student Attitude Inventory

FIGURE 4-2

LRG Formulation Paradigm


occupational information
knowledge of self
career games
personal goals
decision - making skills
personal reality appraisal

educational and general vocational aspirations and goals they hold. The information obtained is then used as input data for the generation of the student's individualized program of studies. The following is a description of this component.

The first two units, or modules, deal with decision making, the consequences of decision making, the times when certain kinds of decisions typically ought to be made, and the consequences should those decisions be arrived at too early or too late.

These are then followed by a series of five modules dealing with a rather detailed analysis of the 12 LRG families suggested by the TALENT data, a description of the characteristics of prototype jobs comprising those LRG's, and a fairly detailed analysis of the skills and abilities characteristic of students going into the occupations representing those LRG's. These five modules utilize a series of four 30-page booklets that are based largely on the analysis of TALENT data, statistics from the Bureau of Labor Statistics, and such sources as the Occupational Outlook Handbook.

These modules are followed by two career planning modules in which the student gets practice in decision making and planning for hypothetical individuals. The career planning exercises are then followed by a module dealing with personal interests and values to be considered in making tentative LRG choices.

In the final module the student and his parents apply what they have learned in the previous modules to arrive at the selection of tentative long-range goals.

This procedure takes place roughly during the period September to March and includes parental involvement in the process. The procedure is then recycled in the coming school year or sooner if desired by the student.

Examples of some of the objectives of the PLAN student goal formulation program are presented in Figure 4-3.

FIGURE 4-3

Sample Objectives - Student Goal Formulation Program

Describe how a person's life style may be affected by his job.

Identify the more important educational and occupational decisions to be made by students and the optimum times for making them.

Recognize that decisions are tentative and subject to change because:

a) your interests and abilities change,
b) the world changes, and
c) you might change your mind because you reassess the implications of your earlier decision.

Given descriptions of students making decisions, recognize examples of decisions which have been made carefully and identify four steps used in careful decision-making.

Given a description of a student and of a decision that he made, describe the most probable consequences of that decision for the student.

Given a description of a decision that a student has made relating to his educational and occupational future, identify additional factors that the student ought to have considered in making his decision.

Given certain undesirable consequences of a decision that a student has made, make a new decision for that student that will probably have more desirable consequences.

You will be able to identify several jobs that would probably be satisfying to a person based on a description of what that person wants in a job.

Given a decision that a student has made relating to his future, describe how this decision allows increased or decreased flexibility in planning and in the options it provides for the student.

Recognize that some decisions allow you more flexibility to modify your plans than others.

Given a "want-ad" description of a specific job, recognize whether that job belongs to LRG III: Business Administration, LRG VIII: Business, Sales, or LRG XI: Secretarial, Clerical.

Compare and contrast jobs in LRG IX: Mechanics, Industrial Trades, and in LRG X: Construction Trades, in terms of (a) nature of the work, (b) education and training requirements, and (c) DAP profiles.

Given a description of a decision made by a student and of the consequences of that decision, identify an alternative decision that could have been made and tell why you think it might also have been a good decision.

Given a description of a student, make a decision for that student which will allow him the most flexibility to do the things he wants to do.

Interpret your DAP scores and draw your DAP profile.

Relate your developed abilities to those of workers in various occupations and LRG's.

Evaluate the implication of your Long Range Goal selection in terms of your current educational plans.

The Willowbrook Computerized Vocational Information System. This system makes individualized vocational information readily available to students and counselors, provides an automated vocational library and cumulative student record, and allows on-line access to vocational and student information. System objectives for the students include: increased vocational exploration, awareness of discrepancies between stated goals and measured attributes, maximization of the probability that the student will choose vocational alternatives which will provide success and satisfaction, and immediate program choices which are congruent with long-range occupational goals.

The use of the computer in such a system as this provides a wealth of evaluation data which can be used to further refine the service being provided to students. It is easy to maintain a running tally of items such as the number of shifts in goal choices, discrepancies, the frequency with which a particular occupation is explored by a student, and the number of times each student uses the computer (Harris, 1970).

The Palo Alto Computer-Based Course Selection and Counseling System. The primary role of this system is to help the student make good decisions about their high school programs. Good decisions are defined as those which are based on knowledge of the alternatives and an understanding of the personal implications of each alternative. The objectives of the system are to provide more information than currently available in order to facilitate better decisions, to relieve the counselor of the task of dispensing basic information about colleges, jobs, and courses, and to advance the level at which student-counselor dialogues take place (Weinstein, 1969).

The Computerized System of Interactive Guidance and Information (SIGI). SIGI is designed to assist junior college students in their career decision making. In addition to assisting students to relate their abilities and interests to vocational and educational options through information and prediction systems, SIGI attempts to assist the students to consider their values. The first step in the program, then, is for the student to explore and define his values (such as altruism or income). Then he is provided information about jobs related to the student's values and, finally, predictive information on the student's chances of success in the various occupations (Katz, 1969a).

Sample Individualized Noncomputer-Based Goal Formulation Programs

Because of the costs associated with computer-based guidance efforts, many agencies have attempted to develop goal formulation programs which, while still individualized, are not dependent upon computer support.

Invitation to Decision. This program, developed by the Palo Alto Unified School District, is based on data obtained from a five-year follow up study of their school graduates. It consists of an instructional booklet replete with a wealth of facts and statistics concerning career choices and outcomes for former students. The major thrust is on the importance of knowing the consequences of specific career choices. The implicit effect of the program is to so fortify the student with data that he is able to assume personal responsibility for directing his own career development.

Three steps are delineated for the process of making career decisions: make decisions wisely; learn how good decisions are made by knowing the facts, knowing the alternatives, and knowing the consequences; and use this information to begin planning your own career (Yabroff, 1966).

Self-Appraisal and Assessment Structure. This program consists of a series of booklets which, while less informative and decision-oriented than the Palo Alto approach, does enunciate for the career-curious student eight self-measurement scales that deal with areas of vocational interest (scientific, mechanical, clerical, computational, sales, social service, verbal, and the arts) and four scales that deal with personal attributes important to success (academic, motivation, energy output, and organization). Students are assisted to assess their interests and characteristics in each area and to identify vocations related to these interests and characteristics (Ostrom, 1967).

The Life Career Game. In this game students make decisions relating to educational, vocational, avocational, and personal/social activities for a hypothetical student. Through this process of simulation the students obtain practice in making decisions and examining the consequences of those decisions, and they are also exposed to a great deal of information about jobs and other career options. Discussions based on the game activities serve to reinforce the students' learning. (Varenhorst, 1968)

In conclusion, a variety of programs have been developed to assist students to formulate their goals. Most of the programs are concerned only with vocational, or occasionally educational, goal formulation. Also, most of them adopt a traditional view of goals as specific objectives to be attained, such as a job or getting into college, rather than the existential concept of goals as what one's *life* should be.

Proposed Models of Goal Formulation Programs

Four different models for goal formulation programs that could be conducted in Career Education programs can be identified. In the following sections each model will be analyzed in terms of the following dimensions: what is the basic character of the program (e.g., programmed instruction)? how will the necessary information be made available to the student? who will administer the goal formulation program? in what specific context will the goal formulation program occur? what special administrative procedures, if any, will be required to implement the program? how can the effectiveness of the program be evaluated?

The Individual Learning Units Model

In this model the goal formulation program would be conveyed through a series of individual, self-contained, learning units which would be incorporated into the students' regular academic program. Five separate strands of these learning units, or modules, could be employed: 1) modules containing information about post high school options, such as jobs, colleges, military service, etc.; 2) modules assisting student in self-assessment and presenting and interpreting available data; 3) modules assisting students to develop the skills of decision-making through the process of goal formulation; 4) modules assisting the students to identify steps through which they can realize their goals; and 5) modules designed to assist students to develop certain personal or social skills.

Within each of these strands a variety of units would be needed to present the necessary information and to assist students to develop necessary skills. Each unit would consist of objectives expressed in performance terms, learning activities, and assessment exercises. Wherever possible, these modules should be incorporated into the academic program, such as by presenting information about various social science occupations through the social studies program and teaching students the skills involved in applying for a job or to a school through the language arts program. This approach is the one being developed by AIR for BAVTE.

Students could access these modules in one of three ways. Modules could be assigned to students according to some predetermined timetable, so that all students work on the same modules at the same time. This would allow for administrative convenience but it is not likely to meet the needs of the students when these needs are most pressing. The second approach would be for students to request the modules when they needed them. This approach runs the risk that students may not take all the modules. The third alternative is a combination of the two, whereby some modules are assigned, such as those presenting basic information and those in which the student formulates his goals, but all of the modules are available to the student on request. In this way students may take modules as they need them but they will still take those that are considered most necessary for their program.

Because of the nature of this model, the goal formulation program could be administered in the same way as the remainder of the student's academic program--in the classroom by the teacher (or whoever is serving the teaching function). However, the teacher's function would be primarily one of administrator, as the modules would be entirely self-contained. Some procedures would need to be established for assigning the modules to the students, monitoring their progress on the modules, correcting the module tests, and returning the results to the students. If a computer is being used to facilitate data processing, it could assume this responsibility; otherwise, a staff member (the teacher or a teacher aide perhaps) would have to carry out these tasks.

Evaluation of this program could be accomplished through analysis of the students' performance on the module tests. This would provide information on how well they had learned the material and skills presented in the module. Statistics on the number and kinds of modules the students request would provide information about the effects of the program on their information seeking behavior. However, additional instruments, such as student reaction sheets, would be required to collect data on the students' attitudes, such as satisfaction with their choice of goal.

There are several advantages to this type of program. First, it requires little in the way of staff time or special facilities for its implementation; those mechanisms that are required are already available for the remainder of the academic program. Second, the program is standardized, so that any students taking the modules will receive the same information and there is less room for biasing factors. Third, the program can be utilized under various instructional patterns, in programs administered within one large agency and in programs conducted by a consortium of agencies spread out over a wide area. Finally, this model can be easily evaluated so that information regarding its effectiveness can be readily obtained.

However, there are two major drawbacks to this type of program. First, it contains little flexibility. Students who question or disagree with certain aspects of a module have no recourse: they take them as they are, or they don't take them. Also, by the nature of the modules, students must fit their responses into a structured format which tends to stifle innovative response patterns.

The second drawback is that the individual learning units must be developed, or acquired from some source. And because the entire program is contained in these learning units, the program will only be as good as the materials used.

Personal Individual Counseling

This model resembles the counseling services in traditional school settings. A counselor could be assigned to a particular group or groups of students at a ratio of one counselor for every 100-200 students. The counselor would meet individually with the students approximately once a month to review student plans, discuss information about the student, assist him to formulate or update his goals, and assist him to take steps to achieve his goals. The counselor would be responsible for the process aspect of the goal formulation program. Basic information, such as information about jobs, would be presented through the students' academic program and work experience.

The counseling could occur in either the academic, work or extra-curricular context. Because the counselor would be responsible for all guidance activities relating to his or her assigned students, he would have to be familiar with both the academic and work-experience facets of the students' prorams.

Implementation of this type of program would require a fair amount of administrative coordination. Schedules for the different counselors would have to be established and some mechanism for making appointments would be required. In addition, office facilities would have to be made available to the counselor for meetings with the students.

Evaluation of the effects of this goal formulation model would have to rely on the subjective opinion of the counselor regarding the student's ability to formulate his goals and take steps to attain them, plus on the student's self-report of the effects of the program. Objective data could be obtained on the student's mastery of the basic information that is presented to him, but not on his use of that data.

This model allows for a great deal of individual guidance to the students in formulating their goals. Students would be able to explore different alternatives with the counselor and evaluate the consequences of each. Moreover, where the students have questions about or objections to the program, the counselor can discuss these with the student and together they can come to some agreement or resolution of the problem. And, if a student has difficulty in mastering certain of the skills, the counselor can spend extra time with him, giving him additional practice.

This model, however, would not be relevant to all Career Education models. Where a large number of students were working or being taught in fairly close geographical proximity, so that the counselor would be available on a regular basis, the model would work. However, if students were fairly widely dispersed, as in some possible EBCE configurations, much of the counselor's time would have to be spent in travel and he might not be available should some special need arise. Also, where a number of businesses or industries are participating in a consortium, coordination among the different agencies regarding the amount of time spent and the tasks engaged in by the counselor would be required.

A second drawback of this model is that it is likely to be in the long run the most expensive of the models discussed. Not only would a professional counselor, or counselors, have to be hired, but the ratio of students reached per counselor man-hour would be quite low, so that many counselors would be required to reach a large number of students. Should agency staff be used to fulfill the counselor role, they would have to receive special training in basic counseling techniques such as effective communication skills. Finally, it is unlikely that this model will increase student benefits sufficiently over current school practices to justify the costs.

A third drawback is that there is much margin for error, bias, or other interfering factors since the counselor is the only influence upon the student.

The Group Guidance Model

This model is based on a combination of peer guidance and counselor guidance. As was true for the previous model, the function of the guidance sessions is primarily to discuss and practice skills involved in goal formulation. However, it is also possible to review and discuss the various kinds of information relating to the process skills during the guidance sessions. Because a number of students are involved in the discussions, it is not necessary for every student to study every occupation (or whatever is being considered); rather, some students can study a specific occupation and the others can learn about it through the guidance sessions. The actual study of the occupations, as well as the presentation of other information, such as data about individual students, would be accomplished through the academic curriculum.

A second characteristic of this model is that each student receives a great deal of feedback as he practices goal formulation skills and actually formulates his own goals. In addition, because a number of students will be participating in the guidance sessions, a number of different opinions, values, interests, and so forth are likely to be respresented. Thus, each student will be exposed to a number of alternative viewpoints of a specific situation which will reinforce his skill in identifying and evaluating alternatives.

In this model the role of the counselor would be played by a teacher or work supervisor, someone with whom the students have frequent contact. The counselor would meet with a group of about 15-20 students once or twice a month at either the school or work site. These sessions would follow a semi-structured format in which problems relating to a particular goal area would be discussed at each session. The students in the group would all be approximately the same age/grade level, so that they would be considering the discussions from similar viewpoints. If students of different ages were participating in the discussions they would be likely to view the problems differently because of their different perspectives.

This model will require a certain amount of coordination to insure that the students are all available at the same time. In addition, facilities will have to be made available, though not to the extent of the previous model. However, because this model operates through the existing framework of school or work programs, the administrative requirements should be minimized. Also, it would not be necessary to assign basic information modules to all the students. Those students responsible for acquiring certain information and presenting it to the group would request the necessary modules from the system.

Evaluation of this program would be more difficult than for the previous programs because there would be a lack of objective data and the counselor would be less familiar with the individual student's performance. However, some form of peer rating could be used, in addition to self rating and counselor observation, to determine how well the students have mastered the skills involved in goal formulation.

This model eliminates some of the problems involved with other models. Since the counselor is a teacher or supervisor already involved in the program, it will not be necessary to hire a person from outside. (However, there would still be costs associated with the time he spent counseling the students.) Also, because the counselor is working with a number of students at one time, he will not need to spend as much time on the goal formulation program.

Finally, it will not be necessary to coordinate the counselor's activities if different agencies are involved in the instructional program, since each agency could, if it chose, have its own counselor. However, it would be desirable to involve students from different agencies in the same groups, to encourage a diversity of opinions expressed and goals considered. This would present other problems of coordination, both in scheduling the sessions so that the students could attend, and arranging for the students to get there. Should these difficulties prove too hard to surmount, however, group sessions could be conducted within each of the participating agencies, for the students involved with the respective agencies.

There are two risks associated with this model. First, the program can only be as strong as the group leader. If a leader is not able to provide effective direction, the program is likely to be less successful. A second, but related, problem concerns the risk of time-loss due to unstructured discussion.

The costs of this model would be less than those of the individual counseling model because fewer counselors will be needed and they will have to spend fewer hours counseling. However, since non-professionals will be used to fulfill the counselor's role, they will have to be trained in basic counseling and group guidance techniques.

The biggest advantage of this model is that it is likely to be more effective in developing goal formulation skills in the students than the previous models. This is primarily due to the opportunity for interaction and discussion between students that this model affords.

The Gaming/Simulation Model

This model is similar to the group guidance model discussed above in that it involves groups of students meeting with a counselor; again, the counselor can be a teacher or supervisor. However, the content of the guidance sessions is different: in this model the group discussions focus around structured game, or simulation, situations, as compared to the unstructured discussions of the previous model. Ideally, the basis of these discussions would be actual case histories of students for whom actual data were available and for whom some information on the actual outcomes and the student's reactions to those outcomes could be provided. However, it would be necessary for the Career Education program to have functioned for some time to have this kind of information available. In the meanwhile, then, the counselor might want to use some of the commercially available games, or perhaps adapt these games so that they would be more relevant. Or, perhaps, some students in the group might volunteer to serve as cases for discussion.

There would be some increased cost with this model because of the necessity for preparing or acquiring the case data for the discussions. However, this should be offset by the enriched experience for the students. Having actual examples with real data to discuss allows them to go through the identical processes they would use in formulating their own goals. In addition, in the game situation they are able to examine the consequences of various decisions. Finally, by determining the content of the discussions through the case studies presented, it is possible to insure that a variety of cases are discussed; this will result in the consideration of a variety of goals and their implications by the students.

Each of the above models was presented and discussed as a discrete entity. However, in designing and implementing a goal formulation program within a particular Career Education program, it would be possible and probably desirable to combine elements of the different models to maximize the strength of the program while minimizing the costs.

CHAPTER 5

CURRICULUM ANALYSIS, ORGANIZATION, AND PRESENTATION

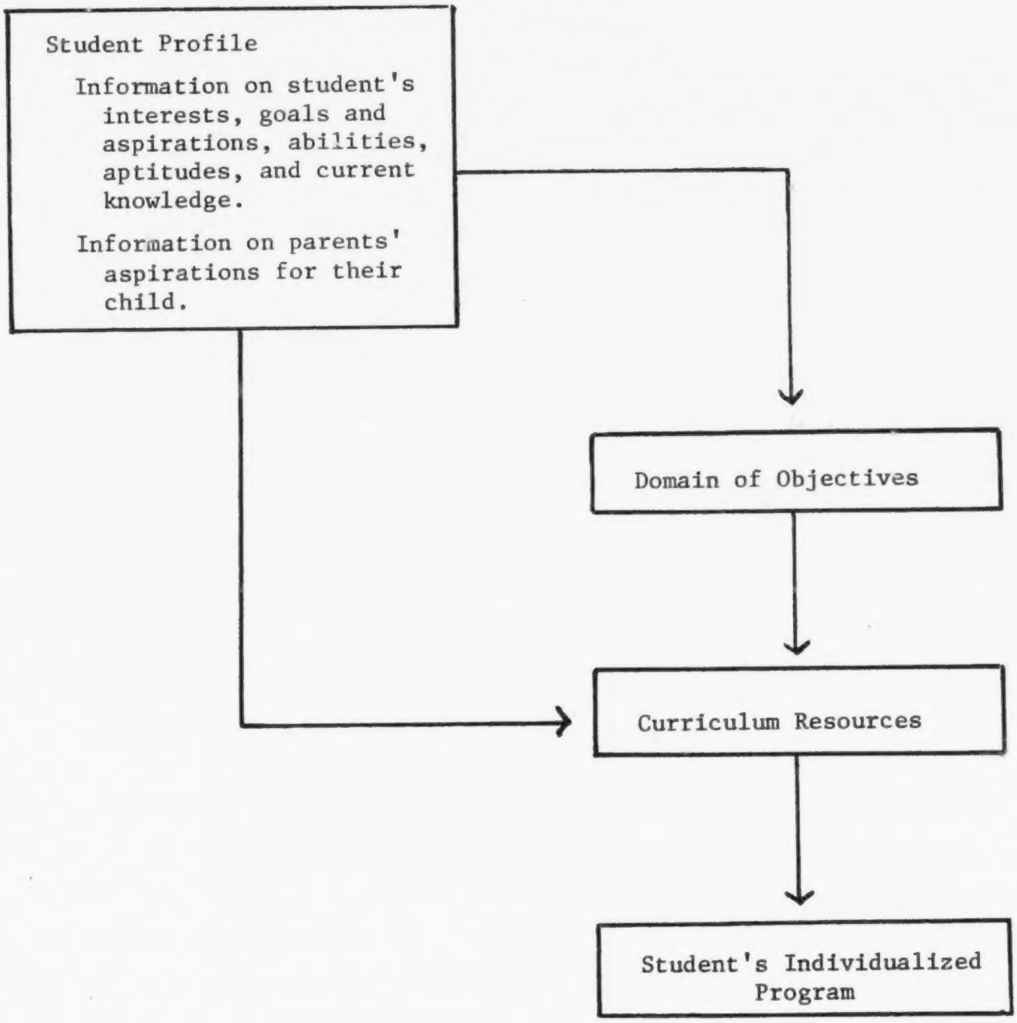
Chapter 5 discusses the analysis, organization, and presentation of the curriculum. This can best be considered when it is viewed as one component in a larger system for individualizing instruction. The outputs of such a system are an individually tailored set of objectives for each student and an individually prescribed set of learning activities designed to help each student master those objectives.

Although there are many variations, the basic system can be described as follows:

1) Information is collected on a student's interests, goals, aspirations, and on his abilities, aptitudes, and current knowledge. (See Figure 5-1.)
2) Information is also collected on the parents' aspirations for their child.
3) This information is then brought to bear on a "cafeteria" of objectives. This objectives "cafeteria" or domain contains a large number of objectives organized and indexed by general competency areas, career goal areas, required areas, optional areas, et cetera. Information about the student is applied to select from this objectives pool a set of objectives uniquely appropriate for the student.
4) This set of objectives plus information about the student are then applied to the curriculum "cafeteria." The domain of curriculum resources consists of learning activities which help the student master the objectives. For each group of objectives there are several alternative learning activities which are appropriate. They differ in difficulty level, amount of reading required, sensory mode, et cetera. The individual's set of objectives plus information on the individual's abilities and aptitudes are used to select from the curriculum domain those specific learning activities which will help him reach his

Figure 5-1

The Individualization Process


Student Profile
Domain of Objectives
Curriculum Resources
Student's Individualized Program

Information on student's interests, goals and aspirations, abilities, aptitudes, and current knowledge.

Information on parents' aspirations for their child.

objectives in the most interesting and efficient manner. The final output,

5) is the student's individualized educational program.

Other parts of this report deal with this system. One discusses the kind of information which must be collected on each student; another discusses the decision rules which must be used to select objectives and learning activities. This chapter discusses the organization of the objectives and the curriculum and the mechanisms of presentation. It is clear that objectives and learning activities must be carefully organized and indexed. Various purposes for such organization will become clear subsequently, but one example may be given here.

There may be a number of alternative learning activities for any one group of objectives. These all must be coded by reading difficulty level, sensory mode, interest category, etc. so that a teacher, a computer, or the student himself can select that activity which best suits his needs and abilities. Without careful organization, resources cannot be effectively used.

It should be emphasized that the present concern does not deal with the substance of the curriculum. Present attention deals rather with content organization and presentation.

Employer Based Career Education will probably be the first important instructional system to combine individualized education and work experience in a major way. In designing such a system, then, one must draw on experiences in the two separate areas:

1) organization of the curriculum in functional work-study contexts, and
2) organization of the curriculum in programs for individualized instruction.

Traditional work-study programs have frequently been justified in terms of making the curriculum more meaningful or relevant to the student. In most cases, however, work and study components of the programs were not integrated well. Study components simply did not seem to relate to the work. Few attempts were made to establish unified sets of objectives for students and then to use thoughtfully combined sets of activities including both work and study to achieve those objectives. Instead, students studied a standard or traditional curriculum in school and worked at only marginally related jobs outside of school. In many cases, the only relationship was both components were considered preparation for non-college careers. In one model work-study program, in Santa Barbara, a program which was very successful from many points of view, 85% of the students expressed the opinion that there should be greater correlation of the work experience with the remainder of the curriculum. Fifty percent of the employers felt the same way. (Burchill, 1962).

In organizing the curriculum for Career Education, primary importance should be placed on learning in a functional context; i.e., integrating work and study. Programs for individualized instruction have generally not contained work experiences, however. Thus there is no operational model for the individualized integration of work and study. As indicated in Chapter 3, though, two of the most important programs for individualization are Project PLAN, developed by the American Institutes for Research, and IPI, developed by the Learning Research and Development Center at the University of Pittsburgh. These individualized programs do contain carefully organized curricula which, with some important modifications to accommodate work experience, can serve as examplars for curriculum organization in Career Education. Organizational elements of these programs will be cited at later points.

The Organization and Codification of Objectives

Objectives referencing is designed to facilitate these functions: 1) the selection of objectives for individual students; 2) sequencing those objectives once they have been selected; and 3) scheduling activities to lead to the mastery of those objectives.

There are many ways objectives can be classified. But there are at least three classification dimensions one must use. One deals with the "level of specificity of the topical content" in the objective. The second deals with the "nature of cognitive process required." (This is best exemplified by either Bloom's Taxonomy or Gagne's Hierarchy.) The third (if the objective is to be truly a behavioral objective) is the "type of activity-criteria dimension." This latter is technically not a unitary dimension, but for practical purposes, may be considered as such. The following sections define these dimensions more precisely.

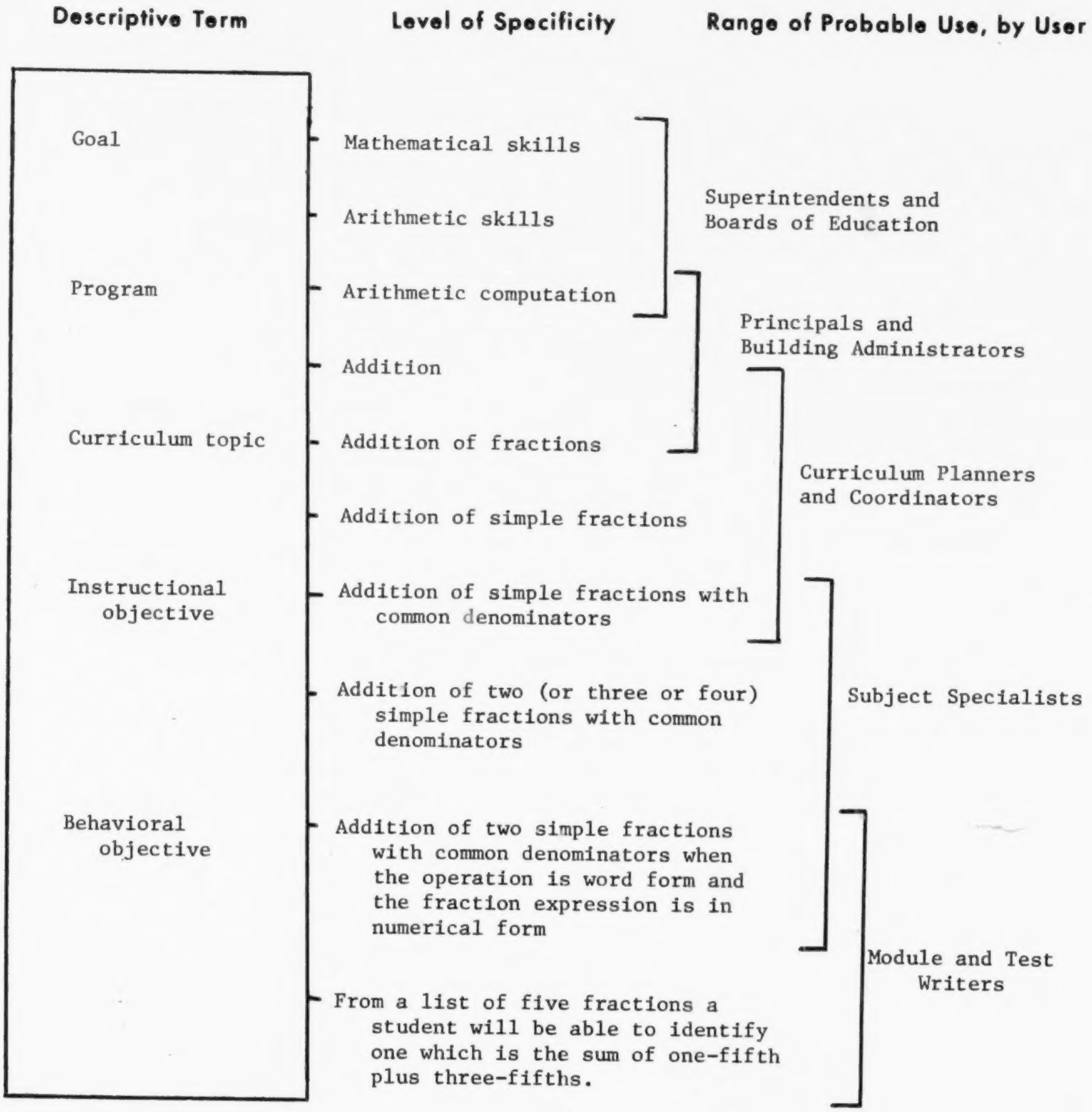
Level of Content Specificity

The specification of the content to be covered in the objective may range from extremely broad to extremely specific. An extremely broad statement of the content to be covered in an objective is, of course, contrary to the basic concept of behavioral objectives. Such statements are generally considered goals rather than objectives, *per se*, and are so broad as to make it difficult to specify the requisite activity or the criteria for success. On the other hand, concentration at the other extreme, at the highly specific end of the continuum, makes it extremely difficult to coordinate and integrate the overall curriculum. It is analogous to being too near the trees to see the woods.

In identifying the general directions in which one wants to go, the topics to be covered, and the areas in which one wishes to devote his resources, one must step back two or three steps and deal with a more intermediate statement of topical objectives. An example of the specificity continuum might look something like Figure 5-2.

The upper levels of this list are more appropriately considered curriculum goals. The intermediate level deals with instructional programs. Down the list the statements might be called instructional objectives. At the bottom of the list are behavioral objectives.

FIGURE 5-2


Descriptive Term
Level of Specificity
Range of Probable Use, by User
Goal
Program
Curriculum topic
Instructional objective
Behavioral objective
Mathematical skills
Arithmetic skills
Arithmetic computation
Addition
Addition of fractions
Addition of simple fractions
Addition of simple fractions with common denominators
Addition of two (or three or four) simple fractions with common denominators
Addition of two simple fractions with common denominators when the operation is word form and the fraction expression is in numerical form
From a list of five fractions a student will be able to identify one which is the sum of one-fifth plus three-fifths.
Superintendents and Boards of Education
Principals and Building Administrators
Curriculum Planners and Coordinators
Subject Specialists
Module and Test Writers

Superintendents and Boards of Education may generally deal with their task in terms of the broad goals of education; administrators and principals in terms of instructional programs; curriculum coordinators in terms of curriculum topics; and teachers, module writers, and researchers in terms of behavioral objectives.

When the position of the topical hierarchy becomes relatively specific, an orthogonal dimension of learning hierarchy comes into play. This dimension pertains to whether the topic to be learned (and the behavior required of the individual) begins to fall into one or another of Bloom's or Gagne's classification categories. Bloom's Taxonomy lists six increasingly complex categories; they are: 1) knowledge, 2) comprehension, 3) application, 4) analysis, 5) synthesis, and 6) evaluation. The first, obviously, is based on simple recognitions and recall. The latter require increasingly more complex cognitive processes involving conceptual organization, integration, and generalization.

The third dimension is a nominal scaling of the specific activities to be engaged in to achieve the objective and the performance criterion level expected.

The distribution of objectives available in educational programs should be monitored as to the type of activity and cognitive process involved so as to preclude inadvertent committment to a limited or unbalanced set. This of course begins to transition objectives from the short range immediate type to the longer range, more developmental type. The important thing to guard against is permitting objectives to be artificially polarized into an "either-or" "short range-long range" dichotomy.

Individual differences in learning styles should probably be met by prescribing objectives that vary in all three dimensions. For example, while students may differ in the nature of the activity from which they learn best (such as independent versus group activity) they may also differ in the length of the inferential leap they can make (level of generality of the content) and also in the level of the learning hierarchy in which they can operate.

A fairly simple differentiation of level of specificity will suffice for discussion purposes. Program goals may be defined as statements at the broadest level of generality. An example would be the system goal that "each student leave Career Education with a marketable skill."

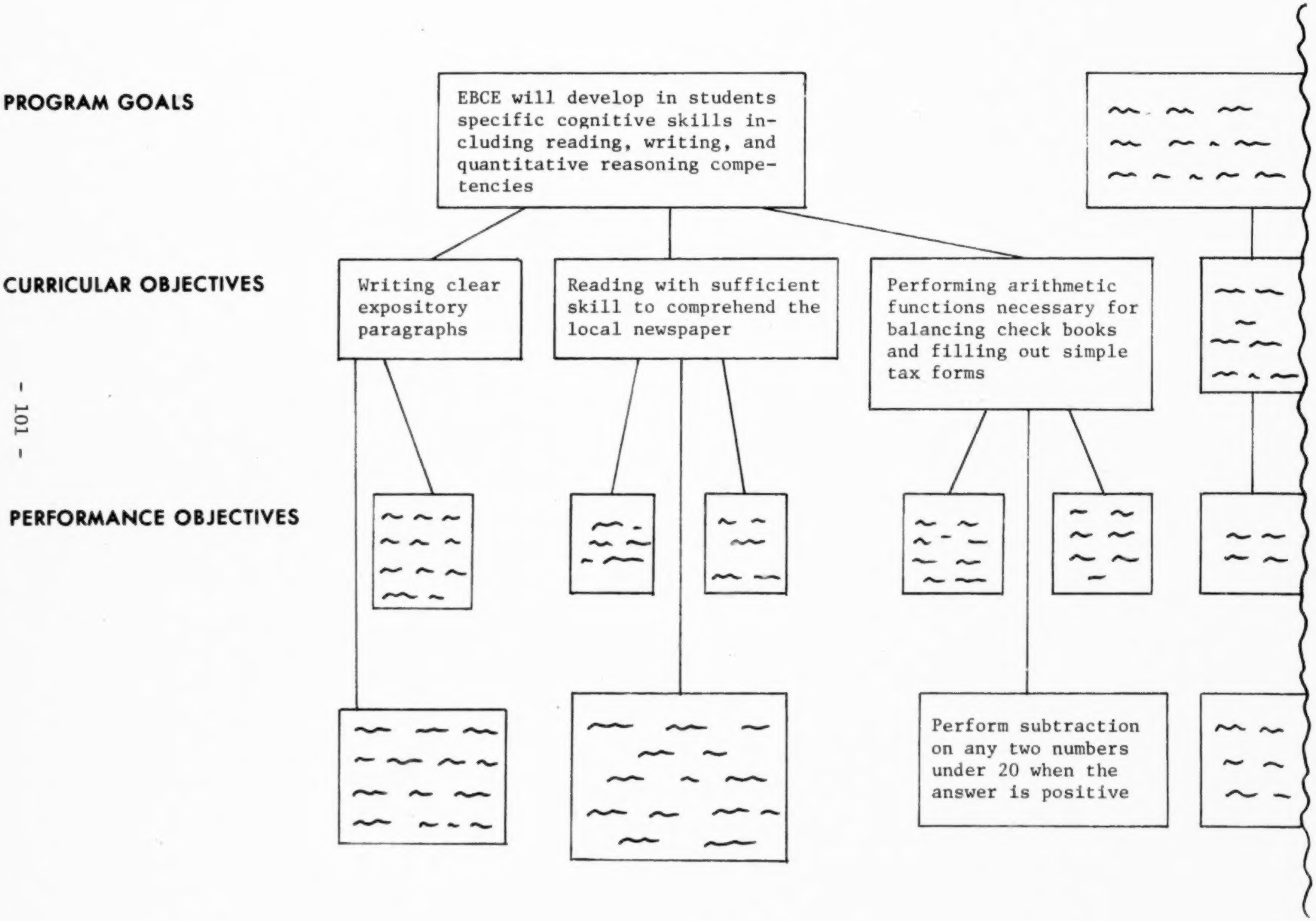
Curricular objectives are derived from broad goals. They may be expressed as skills and knowledge. Examples include objectives such as: "writing clear expository paragraphs," "reading with sufficient skill to comprehend the local newspaper," or "performing the arithmetic functions necessary for balancing check books or filling out simple tax forms."

Performance objectives represent the most specific level. Operationally they may be defined as objectives which can be mastered within a short time period, say two weeks, given that the prerequisite objectives have already been mastered. The following is an example of an objective stated at this level of specificity: "The student can perform subtraction without the use of paper and pencil on any given two numbers under 20 when the answer is positive."

All three levels will be used by counselors, teachers, employees, parents, students, etc. in evaluating an individual's progress and in planning the future. In discussing plans for the coming two years, for example, one cannot talk in terms of performance, or behavioral, objectives. They are too numerous and specific. Curricular objectives would be a more useful level of generality. In discussing plans for the coming month, however, performance objectives are probably the most useful unit of organization.

Program goals can be defined in terms of sets of more specific objectives. Figure 5-3 shows an example of this framework. For any given program goal, there is a set of curricular objectives which helps define the broad goal. Likewise, for any given curricular objective there is a set of performance objectives which helps define this curricular objective. (Theoretically, behavioral objective could also fall into several categories, i.e., it may help to define several different curricular objectives.)

Figure 5-3


PROGRAM GOALS
CURRICULAR OBJECTIVES
PERFORMANCE OBJECTIVES
EBCE will develop in students specific cognitive skills including reading, writing, and quantitative reasoning competencies
Writing clear expository paragraphs
Reading with sufficient skill to comprehend the local newspaper
Performing arithmetic functions necessary for balancing check books and filling out simple tax forms
Perform subtraction on any two numbers under 20 when the answer is positive

Performance objectives are so specific that they are often linked together in groups for administrative convenience. One learning activity is often aimed at a group of performance objectives, rather than just a single one.

One point regarding the substance of objectives should be mentioned. Objectives frequently specify skills such as "writing complete sentences." In these cases the content is not critical. The students may write about jobs, sports, music, etc.; content may be selected to meet the interest or need of the learner. (Selection of content on these grounds will be discussed later.) In other cases, however, content may be critical to the objective. The following is an example: "the student will describe the functions of the three branches of the federal government." In this case, content is part of the objective. Although there are many routes to learning this objective, the content itself is fixed. This distinction between content-free and content-fixed objectives will become important when alternative learning activities are discussed.

Organization to Facilitate the Selection of Objectives for Each Individual

It has been suggested that the curriculum be organized around four broad areas: career competency, cognitive competency, social competency, and personal competency. (Banathy, 1971.)

Career competency would include all objectives which relate to:

- information about and orientation to all viable careers and activities (vocational, avocational, and leisure)
- exploration of various career clusters
- representative skills in various areas
- skills and attitudes of employability
- entry-level skills.

Cognitive competency would include all objectives which relate to:

- communication skills including reading, writing, and speaking
- quantitative skills
- skills of problem solving and decision making
- skills of logic.

Personal competency would include all objectives which relate to:

- information base necessary for decision making
- self-sufficiency in maintaining life, health, and property
- knowledge of self
- positive self-image
- knowledge of alternative life styles
- development of a life style.

Social competency would include all objectives which relate to:

- skills and attitudes relevant to effective group membership
- skills and attitudes relevant to effective group leadership.

For each of these four broad areas, objectives should be sorted into the following categories: 1) objectives required for all students, 2) objectives required for selected career goals, 3) objectives which are important but not required for selected career goals, and 4) optional objectives. Guidance personnel, parents, and computer decision rules would then use these categories to help a student select a set of objectives for himself.

Objectives required for all students. These would include basic skills in all four competency areas. This paper deals with the organization but not the substance of the curriculum. Therefore, the substance of the required objectives will not be specified here. The actual determination of which objectives fall into this category should probably be determined by panels of teachers, parents, employers, selected experts, and students. State requirements must also be considered for this category. State laws frequently specify requirements in terms of time, e.g., one semester of state history. The possibilities for translating these requirements into objectives must be investigated. Decision rules regarding selection of required objectives would be very simple, of course. All required objectives would be selected for any given student's program of studies. Sequencing and scheduling these required objectives is a more complex question and will be discussed in a later part of this report.

Objectives required for selected career goals. Organization in this manner requires first the development of a list of all major career goals. One approach is to identify broad career clusters such as industrial trades, sales occupations, or secretarial-clerical occupations, as contrasted to the identification of all possible occupations. Within these cluster areas, specific occupations could be listed.

Objectives could then be organized into: 1) those required for all occupations in the general career area and 2) those required for specific occupations within the general area. Hopefully most required objectives would be relevant to all occupations in a career area. This would permit a student to pursue a general career area without making an early commitment to one particular occupation. His options would remain open. (Other organizational elements designed to keep the student's options open will be discussed later.) From an information theory point of view, this set-subset approach is the most economical approach, especially if successive binary dimensions can be arranged.

One example of a listing of career goals is that developed by Project TALENT. It lists 12 broad career areas as shown in Figure 5-4. The occupations in any given area are grouped together because individuals in these occupations (or individuals about to enter them) are found to have similar abilities, aptitudes, and interests.

Developing a list of career goals would be a relatively simple task, especially if predicated on an empirical data bank. Far more difficult

FIGURE 5-4

Occupational Goal Groups

1. **Engineering, Physical Science, Mathematics, and Architecture**
   - *Teacher, High School Mathematics*
   - *Teacher, High School Science*
   - *Teacher, College & University Science*
   - *Mathematician*
   - *Chemist*
   - *Engineer, Civil & Hydraulic*
   - *Engineer, Electrical & Electronic*
   - *Engineer, Chemical*
   - *Engineer*
   - *Architect*
   - *Physicist*
2. **Medical and Biological Sciences**
   - *Graduate Nurse (RN)*
   - *Physician*
   - *Dentist*
   - *Pharmacist*
   - *Biologist*
   - *Zoologist*
3. **Business Administration**
   - *Purchasing Agent*
   - *Personnel Administration*
   - *Finance Worker*
   - *Certified Public Accountant*
   - *Business Manager*
   - *Manufacturing Management*
   - *Marketing and Wholesale/Retail Trade Manager*
   - *Efficiency Expert, Industrial Engineer, Production Manager*
   - *Airplane Pilot*
   - *Military Officer*
   - *Teacher, High School Commercial Education*
   - *Retail Store Buyer*
   - *Advertising Worker*
   - *Accountant, Auditor, Comptroller*
   - *Other Workers in Industry, Business, and Commerce*
4. **General Teaching and Social Service**
   - *Teacher, Elementary School*
   - *Teacher, High School*
   - *Teacher, High School Physical Education*
   - *Teacher, High School Economics*
   - *Teacher for the Handicapped*
   - *Teacher (not elsewhere classified)*
   - *Social Worker*
   - *Clergyman*
5. **Humanities, Law, Social and Behavioral Sciences**
   - *Teacher, High School Social Studies*
   - *Teacher, High School English*
   - *Teacher, High School Foreign Language*
   - *Teacher, College & University Social Science*
   - *Teacher, College & University*
   - *Lawyer*
   - *Psychologist*
   - *Librarian*
6. **Fine Arts, Performing Arts**
   - *Teacher, Art (High School, Elementary School, Non-School)*
   - *Theater Worker*
   - *Teacher, Music (High School, Elementary School, Non-School)*
   - *Musician*
7. **Technical Jobs**
   - *Computer Programmer*
   - *Electronic Technician*
   - *Draftsman*
   - *Electronics Worker*
   - *Photographer*
   - *Laboratory Technicians & Research Assistants in Physical Science & Engineering*
   - *Medical Technologists*
   - *Laboratory Technicians in Medical & Biological Sciences*
8. **Business, Sales**
   - *Salesclerk, Checker, Cashier*
   - *Insurance Salesman*
   - *Salesman (not elsewhere classified)*
   - *Sales Manager*
   - *Supervisor in Business*
   - *Proprietor, Contractor (in business for self)*
9. **Mechanics, Industrial Trades**
   - *Airplane Mechanic*
   - *Auto Mechanic*
   - *Mechanic*
   - *Appliance Repairman*
   - *Machinist*
   - *Electrician*
   - *Printing Tradesman*
   - *Machine Tradesman*
10. **Construction Trades**
    - *Carpenter*
    - *Bricklayer, Mason*
    - *Roofer, Painter, Plasterer*
    - *Plumber, Pipefitter*
    - *Miscellaneous Building & Construction Tradesman*
11. **Business, Secretarial-Clerical**
    - *Keypunch Operator*
    - *Computer Operator*
    - *Secretary*
    - *Bookkeeper*
    - *Bank Clerk*
    - *Receptionist & Other Public Contact Workers*
    - *Miscellaneous Clerical Workers*
    - *Stenographer*
    - *Court Reporter*
    - *Typist*
    - *Clerk*
    - *Legal Secretary*
    - *Miscellaneous Computing & Account Recording Workers*
12. **General, Community Service, Public Service**
    - *Auto, Bus, & Truck Driver*
    - *Policeman*
    - *Fireman*
    - *Farming*
    - *Farm and Ranch Owner*
    - *Hairdresser, Manicurist, Cosmetologist*
    - *Military Serviceman*
    - *Practical Nurse*
    - *Clothing and Fashion Tradesman*
    - *Industry, Business, Commerce (not elesewhere classified)*

will be the attempt to specify required objectives for each of the career areas. Panels of experts will have to make the initial analysis. They will use much intuition as very little theory or empirical evidence is available to indicate what skills are actually required for successful work in particular occupations. Failure to assign vital objectives as requirements may significantly affect an individual's success in the world of work. On the other hand, inclusion of unnecessary items will clutter requirements and reduce individual choice. When Career Education has been in use a number of years, empirical evidence from follow-up studies may provide more information. The system should be so designed that revisions in the categorizations may be easily accommodated.

Objectives which are important but not required. Problems in selecting objectives for this category are similar to the area above. An erroneous categorization, however, will not have as strong a potential for harm.

Optional objectives. This category covers all remaining objectives. It should be noted that objectives which are classified as a requirement for one career area can be classified as optional for a different career area. From the student's point of view, optional objectives refer to areas which are unimportant for his career development (in the broad sense of the word). Such objectives cover areas such as hobbies and side interests. Clearly then such optional objectives will have to be sub-classified by interest categories, types of activities, etc.

Several other organizational and design elements will facilitate the effective selection of a set of objectives for each individual. As far as possible, objectives should be written so that students themselves can understand them. This will allow the student to participate in the selection of objectives for his program. It will also permit a student to investigate a career area by studying the kinds of objectives which are required. Finally, it permits a student to think about whether he has already met a particular group of objectives specified in his program. If he feels he has, he should be given the option of taking a test to prove it. If he passes, he need not participate in the learning activity designed to teach that particular group of objectives.

Consideration has thus far been given to the selection of objectives for each student. Objectives are organized into four broad areas and then, for each area, pools of required, useful, and optional objectives are established by career goal. Decision rules will, of course, have to be developed in order to implement a systematic effort at individualized education. Such rules, however, depend on organized pools of objectives. In suggesting a program for an individual, decision rules will first select objectives required for all students. Next, using input on the student's long range goals, rules will select objectives required for a given career goal. Next, rules will select objectives useful for a given career goal.

Decision rules must also deal with the sequencing and scheduling of objectives; the objectives must be organized and coded to facilitate this.

Organization to Facilitate the Sequencing of Objectives for Each Individual

The most important consideration for sequencing is that the prerequisites for any given objective be mastered before that objective is studied. Prerequisites are themselves objectives. The performance of subtraction is an objective. It is also a prerequisite for performing long division, another objective. Every objective therefore must be coded for its prerequisites.

For example, let us examine the following curricular objective: the student will be able to perform all the functions of a bank teller. (It is decided that the student can best learn these objectives by being a bank teller. Procedures for selecting the learning activity which most effectively teaches the objectives will be discussed later.) The prerequisites for meeting this objective must be identified and coded. Prerequisites may include other curricular objectives such as performing the basic four arithmetic functions on any group of numbers, or speaking without gross grammatical or stylistic errors. Each one of these curricular objectives will in turn have prerequisites. Performing the basic four arithmetic functions on any group of numbers will have as a prerequisite the objective of being able to use decimal fractions, and so on. When a student's plans call for mastering an objective such as being a bank teller, the prerequisite structure of objectives must be examined and a sequence determined which will build toward this major objective.

Establishing the prerequisites for every objective is a large task but a necessary one. Students will be in different places at different times. A systematic means must exist for determining whether an individual is ready for a particular task, and if he is not, what he must learn to prepare himself. Prerequisite structures in many academic disciplines, algebra or geometry, for example, already have been suggested. In the absence of further empirical evidence, there is no reason why these prerequisites should not be adopted. Intensive effort will be necessary, however, in identifying prerequisites for objectives in the work situation. Consultation with employers, supervisors, etc. will be necessary. The system should be designed so that revisions of the prerequisites are always possible. As they work with students employers will be able to identify prerequisites they had not previously thought of.

The task of prerequisite sequencing is especially difficult because there are *two kinds of prerequisites*: logical prerequisites and learning hierarchy prerequisites. The former refer to the sequence of logic that is essential to maintain, the latter to the sequence of conceptual development that facilitates learning (c.f. Gagne, for example).

Objectives may also be sequenced with an eye for highlighting the *relevancy* of academic objectives to the world of work. Objectives which relate to a student's work situation, even if they are not prerequisites, may be scheduled to coincide with that experience. This requires an additional coding system. When objectives in the work situation are being coded for prerequisite objectives, they might also be coded for related but not prerequisite objectives. In sequencing a program of studies, decision rules would then scan the individual's selected objectives to determine if any of these could be sequenced to coincide with specific job experiences.

The sequence for any given individual must also permit flexibility and sudden changes. The system must be designed to handle the following kind of occurrence. A student is working at a job. His learning objectives for the past year have been carefully sequenced so that he can perform all the specified prerequisites. In spite of this, his supervisor suggests that he might be able to do a better job if he "understood decimal fractions better." A guidance person would help the student identify the appropriate behavioral objectives related to decimal fractions. A computer check would determine whether the student had mastered all prerequisites necessary for learning the identified objectives. This group of objectives plus any unlearned prerequisites would then be incorporated into the individual's sequence of objectives. (How learning activities will be selected to help the student attain these decimal fraction objectives will be discussed in a later section.)

Objectives should also be sequenced to meet the learning style of the individual. For example, some individuals may learn faster when "applications" are presented first and "background theory" second. Others may prefer the reverse order. This issue will be pursued further in the section on alternative learning activities.

Organization to Facilitate the Scheduling of Objectives for Each Individual

In devising an organizing and codifying system to facilitate scheduling, the following factors should be considered:

1. Because the Career Education models will presumably allow for free student transfer to and from standard educational institutions, Career Education students should attain certain important

objectives at roughly the same age that students in conventional schools do. This will be a special problem with EBCE models.

2. In order to protect Career Education students' self-image and personal development, they should attain certain important objectives in the cognitive, social, and personal areas at roughly the same age that other young people in more traditional educational settings do. And,
3. The objectives selected for an individual must be worked into a reasonable time schedule. No student must be burdened with an unrealistically large number of objectives to meet.

Given these factors a system must be devised which provides for such student information as the following. "Given your stated goal and your target completion date of next August, you must master objectives 1, 2, and 3 by December of this year, objectives 4 and 5 by March of next year, and objectives 6, 7, 8, and 9 by July of next year." The student's goal might be broad, such as maintaining his option to either enter a community college in business administration or take a job in sales; the student's goal might be specific such as taking a job as a carpenter.

The schedule suggests how the required objectives may be worked into the time available. It also considers those objectives which must be mastered by a certain age level. If the student does not meet this suggested schedule, he is informed of this. He must either revise his goals or his target date, or must work faster or longer each day.

In order to provide this kind of information for students, objectives must be coded in two ways. First, each important objective must be assigned a target maximum age level. A student is required to master the objective by the time he has reached that age. Maximum age levels should be assigned only to those objectives required for all students and those objectives required for selected career goals. It seems unnecessary to assign maximum age levels to objectives which are only suggested as useful or optional. It is not expected that maximum age levels will play an important role in scheduling. Rather they are incorporated as a check. Use of the code will insure that important objectives are scheduled before students become old enough to be hampered by not having mastered them. Decision rules should also be programmed to alert a counselor to any student who has failed to master an objective by the assigned maximum age level.

Second, each objective (or group of objectives when they are linked together for learning activities) must be coded for the time it takes an average student to master. It is clear that students will vary widely in the time it takes them to master a group of objectives but a standard figure is necessary. Predictions for individual students may be systematically augmented or diminished depending on how their past record compares to this standard figure. In general, an estimate of the time it will take an individual to master a group of objectives is an important bit of information needed for the creation of realistic schedules.

Depending on an individual's goals, target dates, and speed of progress, he will have more or less time in his schedule to work on non-required objectives. There will be a clear trade-off condition between these non-required objectives and number of months spent in the program. The longer the student spends in the program, the more time he will have to work on non-required objectives. Coding of each group of objectives for an average time to complete makes it possible for a student to weigh the trade-off. He can receive an answer to a question such as, "If I stay in the program an extra six months, will I have time to master objectives 25, 26, and 27?"

Summary Comments

It should be pointed out that the processes of selection, sequencing, and scheduling are not independent. The selection of objectives, for example, affects their scheduling. Likewise, the scheduling will affect selection.

It should also be mentioned that the system must be designed to easily incorporate change. New objectives will be added; required objectives will become optional; career areas will be reorganized, etc. A computerized objectives bank should facilitate the accommodation to change. While published information cannot be revised without great effort and expense, computerized information may be revised almost instantly.

In summary, in order to meet the multiple uses to which the objectives bank will be put, objectives should be organized, indexed, or coded in the following ways:

They must be organized into four broad areas:

- Career competency
- Cognitive competency
- Personal competency
- Social competency

For each of these four broad areas objectives should be sorted into the following categories:

- Objectives required for all students
- Objectives required for selected goals
- Objectives which are very important but not required for selected career goals
- Objectives which are somewhat important but not required for selected career goals
- Optional objectives

In order to do the above, a list of alternative career goals must be established.

Objectives should be written so that students themselves can understand and use them.

Objectives must be coded to specify:

- -prerequisite objectives
- -related objectives
- -average time to mastery
- -maximum age level (required objectives only)

Finally, each objective must be coded to specify the alternative learning activities designed to teach it.

The logistical problems of developing and organizing such an array will be discussed in a later section.

Organization and Codification of Learning Activities

A learning activity is an activity which helps the student master a group of objectives. A learning activity may consist of reading Catcher in the Rye and answering a set of questions on it; attending a school board meeting and writing up the minutes; or working as a sales clerk in a drug store for a set period of time. A complete learning activity includes: a stated group of objectives, content (Catcher in the Rye), a specified learning experience (read and answer questions), an environment (home, drug store, etc.), and a test which measures whether the objectives have been mastered. The work experiences available in EBCE are considered learning activities. In order to truly individualize an instructional system, several alternative learning activities should be provided for any given group of objectives. This enables a student to experience the activity which is most appropriate to his own personal learning style. It is clear that if several alternatives will be available for every set of objectives, a systematic method of labelling and indexing these alternatives must be provided so that appropriate activities tailored to individual needs can be selected. This section will discuss the various dimensions of learning activities which must be indexed in order to 1) provide for individual differences and 2) provide logistical support for the varied activities.

Indexing to Provide for Individual Differences

Ideally, all of the following dimensions should be indexed.

Reading level difficulty. For any given group of objectives, activities might be created at three different reading difficulty levels - low, medium, and high. These levels would not be constant but, instead, relative to the general target age that the learning activity is designed for.

Interest area or content examples. As previously mentioned, objectives frequently specify skills, such as writing complete sentences. In these cases the content is not critical. The student may write about jobs, sports, or music. In cases like these several alternative kinds of content should be available to satisfy the varying interests of the students. Arithmetic skills, for example, can be taught using baseball scores or cooking recipes. The number of alternative content areas for each learning activity need not be fixed. With some groups of objectives it may be quite simple to incorporate many alternatives in content. A learning activity which involves reading a short story, for example, might specify a choice of five different stories. With other groups of objectives it might be quite difficult, time consuming, or expensive to specify a number of different alternatives. As a general rule, however, the more alternatives the more effective the system.

Amount of reading involved. This dimension is quite different from reading difficulty level. Independent of his reading ability, a given student may be "turned off" by a learning activity which requires a great deal of reading. Alternatives to reading such as watching a film, writing something, etc., might raise this student's learning efficiency. This dimension might be coded by estimating the proportion of total time in the activity which is spent in reading.

Variety of tasks. This dimension resembles the last. Some students may learn more effectively when the learning activity consists of a variety of tasks. Other students may prefer concentrating upon one or two tasks.

Sensory mode. Independent of variety, some students may learn better when material is presented in the visual mode, others may benefit more from the audio mode.

Degree of social involvement. A learning activity may be a relatively social event in which the student interacts with other students, employees, supervisors, adults, etc. or it may be a completely individual effort.

Approximate time required. Alternative learning activities are likely to require differential amounts of time. Students and guidance personnel may want to consider the trade-offs. Alternative A, for example, may contain a variety of tasks but require twice as much time as alternative B.

Difficulty level. This refers to a dimension of difficulty other than reading. It need not necessarily be the same measure for all activities. For some groups of objectives three levels of arithmetic reasoning abilities might be incorporated into the alternative learning activities. For other groups of objectives, several levels of mechanical reasoning abilities might be incorporated into the alternatives.

Cost of learning activity. The variations in cost among alternative learning activities may be substantial. Cost should be considered in selecting a learning activity. It is not the role of this paper to discuss the relative weight of learning effectiveness versus cost. A few basic decision rules might be mentioned, however: 1) If no difference is predicted in the effectiveness of learning activities A and B, select the least costly activity. 2) If learning activity A is predicted to be only marginally more effective than B, but it is substantially more expensive, select B. 3) If learning activity A is predicted to be substantially more effective than B, and it is only slightly more expensive, select A.

Learning Style. Looking again at the attempt to cater to individual learning styles, it should be mentioned that the state of the art is not highly developed. We can with a good deal of certairty predict which reading difficulty level will be most effective for a given student, provided we have reading test measures on that student. With a great deal less certainty can we predict which sensory mode or what level of social involvement will be most effective for a given student. However, creating alternatives on these dimensions is important since this will allow us to collect the empirical evidence required for improving predictions.

Creating alternative learning activities along each of the dimensions mentioned would require an impossibly large number of alternatives for each group of objectives. It may be useful, however, to examine this in the extreme. Given a group of objectives, if an alternative learning activity were created for each of 3 reading levels, 3 interest areas, 3 proportions of reading involved, 3 levels of variety, 2 sensory modes, 2 levels of social involvement, and 3 levels of (other) difficulty, 972 learning activities (3x3x3x3x2x2x3) would be created for this one set of objectives. Because this is not realistically possible, it will be necessary to combine levels of dimensions which are likely to correlate. For example, it may be found that most students who have low reading ability learn more effectively when a variety of tasks are employed. Dimensions must not always be combined in the same way but they must always be combined. If 5 alternative learning activities were available for any given group of objectives, a great deal of opportunity for individualization would be provided. As the program is developed and tested, empirical evidence should be gathered to determine which dimensions are most important.

In general it is important that the student himself understand the differences among the alternative learning activities. In this way he can take part in the selection of those learning activities he feels are most applicable to his own abilities and interests. The curriculum must be organized in such a way that the student can take some responsibility for his own training. In a similar vein students should be encouraged to develop their own learning activities. This procedure is easily incorporated into the model inasmuch as a test is available to measure mastery of each group of objectives. If a student can pass this test on the basis of a learning activity he developed for himself, more power to him. If he does not pass, he has lost nothing but time. He can always participate in one of the planned alternative learning activities.

Indexing to Provide Logistical Support for the Varied Activities

Each learning activity must be labelled and indexed to facilitate physical arrangements and scheduling. If an activity requires a film projector, for example, the teacher, instructional manager, supervisor, or student must know in advance so that proper arrangements can be made. If such arrangements are not possible, an alternative learning activity may be selected.

Each learning activity should be indexed for the following requirements.

Degree of teacher supervision required. Activities will vary on this dimension from 0 to 100%. A number of learning activities in which no teacher supervision is required can easily be envisioned. The student picks up the learning materials, studies them, takes a criterion referenced test, and submits test answers for machine grading. Other learning activities, say elements of speech improvement, might require a teacher to work with the individual for 80% of the learning activity.

Requirement for a specialized teacher. Certain learning activities may require a specialized teacher : lessons on a musical instrument, for example.

Number of students required for the activity. In an instructional system in which each student progresses at his own rate, an activity which calls for several students to work at the same thing at the same time presents a minor logistical problem. The instructional manager and the student must be alerted to this need in advance. An example of such an activity would be a debate on the merits of capital punishment. If student progress is being monitored on the computer, sophisticated programming could provide for a scan of the progress of all students at the learning center. The computer output would be the suggestion of a convenient date for the seminar meeting.

Special equipment required for the activity. This might include equipment such as film projectors, slide projectors, microfiche readers, tape recorders, laboratory hardware, teaching devices, etc.

Requirement for external arrangements. The instructional manager and the student should be alerted if the learning activity requires external arrangements. For example, the activity may involve an interview with the local chief of police.

Approximate time required. This will facilitate scheduling.

Location. Can the student work on the activity at home or must he be at the learning center or at work, etc.?

Other special requirements. This is a category for miscellaneous needs.

Work Experience

Work experience is a learning activity and should be classified as such. A given work experience is suggested for a student's program of studies on much the same grounds that other learning activities are suggested. That is, given a group of objectives, alternative learning activities are analyzed and that activity most likely to be effective, given the individual's learning characteristics, is selected. The curriculum should not be built around work experiences simply because they are available. Rather, the work experience is considered as one important kind of learning activity which can help a student reach his goals. In this way the work experience becomes fully integrated with the curriculum. Work experiences should be identified, defined, or created to meet various groups of objectives. At the same time decision rules must be designed to take full advantage of the work experience as a means of helping a student reach these objectives.

Proper placement in work experiences is, of course, critical to the student, the employer, and the general success of the program. Effective use of the objectives pool can help insure appropriate placement. Several important variables will be discussed here.

Prerequisite skills. Each work experience will have certain prerequisites. The student must demonstrate adequate performance in these prerequisites before taking the job. As indicated in the preceding section, prerequisites should be defined in terms of objectives. A student's program of studies can then contain a sequence of objectives which prepare him for a particular work experience. Care must be taken to insure that all prerequisites are defined for a given job. Task analysis experts should probably consult with employers and supervisors on this issue. As students participate in the work experiences, supervisors will probably identify prerequisites they had not previously thought of and eliminate prerequisites they find unnecessary. The system must be structured so that revisions can be easily incorporated.

Level of work habits required. Although listed separately, this is really simply a special kind of prerequisite. It should be defined in terms of the objective or group of objectives which the student is required to master before taking the job. Some work experiences will not require a high level of good work habits. The work itself will be seen as a means to teach good habits. For others, however, a high level of work habits may be essential. This may apply particularly to areas such as continuous process manufacturing.

Full use of the objectives domain must be made in specifying requirements for a given work experience. There are a number of requirements or conditions, however, which are not reflected in the objectives and which must be identified and indexed for each work experience. These include 1) requirement of physical strength, 2) health requirement, 3) sex, 4) other special requirements. While discrimination by sex must be avoided, there are occasional legal requirements for the selective consideration of sex. Further, student preference patterns may be involved. Other special requirements might include miscellaneous items such as a "no arrest" record, a minimum height requirement, or the requirement that a one-day, state administered course for food handlers be taken.

To facilitate scheduling, each work experience must also be labelled and indexed for the following.

Location. If Career Education is managed by a consortium of employers, as in the EBCE model, work experiences might be available in a large variety of different locations.

Hours. This refers to which hours in the day the student must be available for work.

Minimum number of weeks a student must work on the job. Employers and supervisors will undoubtedly have opinions about how long a student must work on a job in order to justify training him. A supervisor of a department may feel it simply does not pay to bother with a student if he will be there, say, only two months. Care must be taken to insure that each work experience is long enough to both satisfy employers and supervisors and to be worthwhile for the student. In general, the amount of time a student devotes to a given work experience should be determined by all those factors which help create his individual program of studies, e.g., his long-range goals, his rate of progress, etc. Putting a minimum time period on each work experience adds one important constraint to the selection and scheduling process.

Learning activities other than work experiences are designed to cater to different reading levels, sensory modes, etc. Reality constraints prevent designating these kinds of characteristics for jobs. It is also questionable whether such alternatives are desirable. If EBCE is viewed in part as a system designed to shape students to live in the present world of work, then the work experience itself might be viewed as one of the final steps. In this sense the experience should be structured to resemble reality. Students must learn to use effectively whatever sensory mode, etc., is required in the job.

There will be a certain cost, or cost savings, associated with placing a student in a given work position. This sum must be estimated and listed for every work experience.

Learning Alternatives. Turning to a different area, whenever possible a non-work type learning activity should be designed to teach the same group of objectives which a work experience does. This will serve as a back up for cases in which the most appropriate work experience cannot be arranged. Real life constraints suggest that it will not always be possible to arrange for each student the work experience best suited to him.

Concluding Comments

Organizing the curriculum in the ways that have been suggested is a very large but feasible task. It is, of course, difficult to predict in terms of numbers the kind of work load involved, but variables should be explored. If we assume that the average student can master 12 performance objectives per week, that he works 48 weeks per year, and that he stays in the program for 4 years, then the average number of performance objectives completed by a student would be just over 2,300. The question is, if the average student uses about 2,300 objectives, how many more objectives should be available in the total bank to provide for adequate individualization. The answer, of course, depends on the substance of the curriculum and cannot be dealt with here. Rough estimates may be ventured, however. A bank of 5,000 objectives would permit only a small amount of variation and individualization. Each of these 5,000 objectives must be sorted into a number of categories and coded along 5 dimensions.

Let us turn now to the number of learning activities. If one learning activity covers 5 objectives, then a minimum of 1,000 learning activities would be required to cover all objectives. However, it is important to have alternatives for the same group of objectives. Let us assume that 100 of these activities cover very basic and important objectives. For these activities we will provide 4 alternatives, for the remaining activities we will provide only 2 alternatives. This yields a total of (400 + 1,800) 2,200 learning activities. Each one of these activities must be coded along 16 dimensions (more if it is a work experience learning activity).

This kind of estimate, 5,000 performance objectives and 2,200 learning activities, is speculation -- necessary because the substance of the curriculum has not yet been specified. It does suggest, however, the minimal level of development effort required. One can see how changes in variables such as the number of years the average student spends in the program or the number of alternative learning activities which are provided, can significantly affect the overall total.

It may be useful to examine Project PLAN - a somewhat similar program for individualization. Project PLAN provided individual learning units in 4 basic subjects -- mathematics, science, social studies, and language arts -- for grades 1 through 12. Approximately 6,000 behavioral objectives were specified. This required 2,700 learning activities and a total of 250,000 curriculum descriptor codes to index those activities. A comprehensive EBCE system will require at least that many activities but perhaps as many as a million descriptor codes because of the inclusion of work experiences in addition to formal academic instruction. If the EBCE model involves personal and social development as well, the complexity will be increased perhaps another 10-20%.

It should be mentioned that it will not be necessary for EBCE curriculum developers to write all the objectives. A large number of useful behavioral objectives have already been specified in PLAN, in the UCLA objectives bank, and in other projects,and these could be adopted. Similarly, it will not be necessary to create all the learning activities. Many may simply be adopted from other projects and curricula. In addition, a major curriculum development project for Career Education is currently underway at AIR, Palo Alto.

It will be necessary to code and index all of these objectives and activities, however, to conform to specific program procedures and requirements.

Five thousand behavioral objectives and 2,200 learning activities will provide a respectable amount of individualization. It permits a fair degree of choice in selecting both objectives and activities. If development cost is a problem, the system can be designed with fewer activities. In general, the system development cost can always be reduced by eliminating alternatives -- say by providing only 2 alternative learning activities for the major groups of objectives. This, of course, reduces individualization. There is a clear trade-off between development costs and capacity for individualization. It should be noted that development of the system is basically a fixed cost which is not affected by the number of students who will participate. Development costs per student, then, can be quite low if a large number of students are involved.

One approach to development would be to start the system with few alternatives, but a planned capacity for many. The system could be enlarged during the first few years of operation. Expansion could benefit from formative evaluation.

The importance of the computer in the operation of an individualized Career Education system should not be underestimated. EBCE will involve many students participating in many different kinds of activities in many different locations. Monitoring the progress of each student; suggesting appropriate objectives, given a student's long-range goals; and selecting appropriate learning activities, given individual learning styles, is a major information management and decision making task. The computer can be a very effective aid. As previously mentioned, the computer also facilitates making revisions and changes.

The system could be operated without a computer. However, it would require a very low student-counselor ratio. (The word counselor is used for want of a better word.) In order to assure effective individualization, the counselor would have to spend a great deal of time with each student in the selection of objectives and learning activities, and the monitoring of progress. Operating a comprehensively individualized program without a computer would be feasible and cost effective only if a very small number of students participated in it.

In concluding, certain basic advantages which result from the recommended organization of the curriculum should be pointed out.

First, the system is designed to easily accommodate formative evaluation and revision. The effectiveness of each learning activity can be judged by its success in teaching its specified objectives. Those that are ineffective, as measured by student success on criterion referenced tests, can easily be revised or eliminated. Because students must always take a test after completing a learning activity, continual empirical evidence for evaluation is provided. Learning activities can be easily changed or eliminated without affecting the rest of the curriculum because they are discrete modules. This is far superior to a textbook, for example, in which changing one chapter requires printing a whole new edition.

The system is also designed to accommodate changes in the society. Change will doubtlessly affect requirements for career positions, student interests, required social competences, ways of spending leisure time, etc. These kinds of changes can be accommodated by adding and reorganizing objectives and by adding and revising alternative learning activities.

The system is designed to offer instruction which is relevant to student needs. An individual's program of studies is based on objectives which are derived from his personal long-range goals and from the basic requirements of living in the society. The individual program of studies consists of learning activities which are selected to match student abilities and interests.

Finally, the system involves the student in planning and structuring his own education. The student participates in the formulation of his individual set of learning objectives. He also participates in the selection of learning activities to meet these objectives. If he wishes, he may create his own learning activities. He is provided with information which makes him keenly aware of his alternatives and the consequences of his action or inaction.

CHAPTER 6

THE REQUISITE INFORMATION SYSTEM

It should be clear from the foregoing chapters that extensive information demands must be made on an instructional system if truly individualized educational experiences are to be offered to students. The quantity of information required will be prodigious. Its acquisition though, must, of necessity, be such as not to intrude unduly on the instructional program. Finally, its retrieval from storage must be expeditious and of maximum convenience to the user.

Data refers to objective information gathered either from student records, through the administration of some form of test or other structured collection device, or from systems operation. Since data collection efforts are costly and time consuming (and generally are fraught with negative overtones for students), efficiency in such efforts is demanded. Further, the utility of such efforts must be made patently obvious to participants in the collection efforts.

Data Applications

Data should serve three basic purposes in individualized Career Education. First they should serve in the guidance and counseling of pupil participants; secondly, and highly related to the first purpose, they should serve in efforts at individualizing students' educational programs; and third, they should serve in the periodic revision of the Career Education program. The cause of efficiency will best be served if individual bits of data are collected and constituted such that they can serve more than one of these purposes.

The basic tenet of this chapter is that data should demonstrably assist each participant in understanding himself and in preparing for life. The student should be privy to all data collected. Further, except for research purposes, esoteric statistical machinations and methods of score presentations should be eschewed. Finally, methods of data collection and utilization which do not actually function to this end should be revised until they do (or scrapped if there is only little likelihood of sucessful revision).

Data Requirements for Guidance and Counseling

Such data as name, birth date, home address, parents' or guardian's name, educational course history, attendance record, transportation requirements, health problems, deportment record, standardized achievement test scores, results of screening tests for ability and interest, etc. are of course minimal requirements. The basic source for pre-existing administrative data would be an enrollee's cumulative record or other school-kept records.

Current information would have to be collected and processed by the pupil personnel service in the Career Education program.

AIR's experience of the past five years has convinced us that an individualized guidance program is the sine qua non of a truly "individualized" educational system. Humanization of learning demands that education must focus on the developmental needs of the person and his attitude toward himself, not as a by-product of basically cognitive-level instruction but as an important outcome in itself. Such an outcome is one possible result of early and continued contact with a professional counselor. The majority of pupils do not receive such extensive personal contact however. The goal of an individualized guidance program is to enable each student to evolve a unique profile of specific competencies, self-awareness, self-planning and decision-making skills, and behavioral propensities which will lead to maximally satisfying educational, occupational, avocational, and social adjustment. Data must be collected to complement the overall guidance and counseling program in the development of self-awareness, self-management skills, patterns of facilitating social behavior, and long-range goal formulation. But very thorny problems for developing data collection and utilization mechanisms will be encountered. Many special procedures will have to be developed.

Self-awareness. Specially constructed or adapted surveys will be needed to assess general student interests and values, developed abilities (such as reading comprehension, mechanical reasoning, etc.), motivation level, physical capabilities and limitations, expectancies, etc.

Self-management skills. The assessment of planning, self-responsibility, self-reward (planning for the establishment of rewarding contingencies), and other self-management skills will also involve the construction of special exercises, simulation techniques, etc.

The facilitation of good social behavior. Of special interest here are those behaviors which are usually referred to in such ill-defined phrases as "good attitude," "easy to get along with," "relates well," etc. Some basic behavioral or critical incident analyses will probably be required for the development of assessment techniques. These could then be transformed into observation schedules for both student-observation and employer- or counselor-observation. It would be possible to observe both "positive" and "negative" social behaviors; the goal of data utilization should be encouraging the positive and eliminating the negative behaviors.

Long-range-goal formulation. This area is one of the most important to the concept of individualized, career relevant education and was discussed in an earlier chapter. Basically, long-range goal formulation involves allowing a participant to rationally choose that portion of the total educational program maximally suited to his predispositions, such that he comes out of the program with (1) practical occupational skills and (2) a clear entry into either satisfying gainful employment or further education.

Required data for goal formulation would include much of that previously mentioned; including but not limited to:

a. school records, such as student's
    (1) past plans and goals
    (2) academic history and measured achievement
    (3) behavioral or critical incident records

    - (4) work history
- b. student's (and parents' perception of the student's)
    - (1) developed abilities and physical capabilities
    - (2) interests and values
    - (3) motivation level
    - (4) expectancies
- c. teachers' judgments regarding
    - (1) verification of above
    - (2) the student's study skills and capacity for self-management
    - (3) the student's social behavior patterns
    - (4) initial problem screening.

In addition, students must have ready access to data which describe the range of alternatives open to them in terms of both further education and gainful employment opportunities.

Also of considerable importance in this regard are empirical data which describe the relationships existing between various patterns of talent and actual job satisfaction and/or membership in occupational groups. The best source of such data is probably that generated by the Project TALENT survey followups. These data banks are public domain information and are easily accessible either on tape or via analysis service contract.

Such data, when coupled with a student's own profile of equivalent data, would be of great potential as a planning aid in the formulation of more realistic goals.

Data Requirements for Individualized Programs

In order to channel participants into portions of Career Education that are most likely to produce satisfactory outcomes, it is necessary to first estimate the student's entry level in terms of his interests, specific job-related competencies, physical capabilities, and long range goal selections. These data will be generated mainly as a result of the operations which have been mentioned in the previous sections. An exception is the item "specific job-related competencies." These represent skills which are prerequisite to the performance of various jobs which presumably would be available as part of the various Career Education models. This will require information such as that provided by a detailed task analysis and diagnostic criterion-referenced testing program, so that skill deficits can be diagnosed and specific remedial learning episodes provided. Other necessary data include:

1) State and local legal requirements,
2) Local social/political constraints and preferences,
3) Student opportunities,
4) Availability of support, and
5) Resources of the Instruction System
    a. Objectives
    b. Instructional methods
    c. Instructional content
    d. Curriculum organization
    e. Work-study opportunities
    f. Special education services available in the EBCE system

Data Uses for Evaluation and Program Improvement

Data Requirements for Program Monitoring and Evaluation

Data useful in assessing participants' status relative to the degree of implementation of various program components could be thought of as process, or formative evaluation. It is important that each participant, his family, his counselor, his employer, and the system designers, have continuous access to evaluation data. If the system is failing a student, in that he is choosing poor programs (objectively defined), failing to acquire self-planning skills and acceptable patterns of social behavior, and obviously not making it in terms of employment prerequisites, the system must be made aware of it before the failure is complete. Problem areas could be automatically flagged for special attention by a special group whose function would be to handle "emergencies."

Also stressed would be feedback of job and school performance. The incentive of guaranteed job placement, perhaps government or program financed, if necessary on a temporary basis, would be a powerful incentive for acquiring competencies up to a certain standard. Some incentive is essential if Career Education is to be successful. If allowed to merely function without placing some objectively determined reward on successful performance, we are forced to rely on that oft cited platitude "learning for its own sake." There is no reason to believe potential EBCE enrollees will be seriously motivated by this.

Some data would serve the purpose of assessing the impact of the Career Education model. These data might be in terms of intended student behavior and attitude changes, effects on the existing educational system and community as a whole, side effects, costs, etc. Ideally, much of these data will be generated by the system and can be collected and summarized for this purpose. The most important decisions to be made regarding the worth of career education and those who will be making those decisions should be identified well in advance of this collection and summarization so that their needs will be served.

Data Acquisition

The data referenced in the preceding sections are more extensive than those required for the implementation of any educational program up to this time. Career Education must be truly data-based to function effectively. Student data sources include the participants' past school records, employers, teachers, counselors, parents, and the participants themselves. In addition, other data are required regarding the educational options available in the particular Career Education program in operation, the educational requirements of law and society, the relationships between various student characteristics and success in various occupational and social roles, and the skill requirements of jobs. Sources for such data must be identified and tapped.

Three data collection procedures will probably provide the bulk of data needs. The first procedure is simply recording data from already existing sources. The second is to administer already existing tests, questionnaires, or other data collection forms. The third procedure would involve the collection of observational and other forms of unobtrusive measures. Each of these three categories must be explored in depth, in terms of actual collection and processing methods and schedules of collection relative to the school year.

Much of the data needed may fall into the latter category. For example, student history data should include not only past course work, grades, etc., but should also include information on the materials which were used, success with various teaching procedures (such as small group instruction, individual assignments, etc.), learning styles, capacity for self-direction in completing assignments, etc.

Another example is in the area of assessing occupational interests and preferences. Although there is certainly some utility in the use of so-called "expressed interest" inventories, AIR experience with aircrew selection and Project TALENT has demonstrated the greater stability and predictive validity of "functional interest" tests. Such tests concentrate on facts for which some sort of independent verification would be possible. An example of an expressed interest item would be "How well do you like activities related to government?" or "Would you prefer to be a class officer rather than a member?" The corresponding example of a functional interest item would be "How many times in the last three years have you been an officer of a class, club, or other organization?" It is felt that the development of interest inventories composed of the latter type of items would be a major contribution.

A final example is the use of behavioral observations, in preference to ratings, for teacher, parent, and employer reporting purposes. Ratings often tend to be influenced by recent events and by level of performance on one particular outstanding trait. A most useful procedure for direct observation of student behavior is the critical incident technique. In using this technique, critical incidents are collected from potential observers in response to questions designed to elicit their recollections of specific important behaviors. These records are analyzed to categorize the critical student behaviors which are reported. These behavior categories, with specific examples, are then listed on a performance record which serves to define the various categories. Raters can then simply record the occurrence of student behaviors as they are observed. Data derived from such records are directly related to the frequency of important student behaviors.

Data Storage and Retrieval

The complexity of an individualized career education program, the likely geographical dispersion of its participants, and the wide range of potential users of the systems data bank virtually dictate the creation of a centrally-located data storage and processing system. Considerations of cost and efficiency suggest that a computer serve as the basis for this system. The general availability of electronic data processing (EDP) systems which could provide for remote data access and on-line processing could probably be assumed in the schools and industries which would participate in Career Education.

In establishing any file or set of files of this type, there are several questions that must be answered. For example, what data will reside in what type of file; how are the data to be used; who is to have access to what data; how often is a particular bit of data going to be used; how rapidly must data be accessible; etc.?

Three critical areas should be considered in the design and development of a computer-based data storage, processing and retrieval system. The first is the creation and maintenance of needed data files. The second is providing necessary access to files for the purpose of monitoring and reporting the data residing therein. The final area relates to the use of the data in career planning and in generating individualized programs of study. The three areas are highly related, in that a decision made in one area will most likely influence decisions made in the other two. All decisions must consider issues of cost and the practical constraints imposed by the other parameters of the educational model.

It is probably safe to assume, however, that the system should have the following characteristics:

1) Open access to the student and his authorized users
2) Restriction and identity security for unauthorized users and "browsers"
3) Frequent update
4) Rapid access
5) Selective retrieval
6) Use relevant printout format
7) Erase safeguards
8) Cross indexing and cross validating capability
9) Provision for fill extension
10) Critical value systems alerting
11) New entry discrepancy analysis
12) Suspense date and overflow deletion procedures
13) Hard copy printout

CHAPTER 7

INDIVIDUAL PROGRAM PLANNING

There are two major steps which must be undertaken in order to create the necessary capability for individual program planning. They are the development of appropriate program planning decision rules, and the development of procedures for the implementation of those decision rules once they have been specified.

This chapter will discuss, in turn: 1) requirements for decision rule development; 2) alternative procedures for decision rule implementation; 3) two alternative approaches which have been implemented in the past which might serve as prototypes for career education programs; and finally, 4) limitations in the planning of EBCE programs.

Requirements for Decision Rule Development

Since the decision rules that are adopted are the very heart of an individualized education program, it is essential that they reflect the philosophy of the intended program as well as the physical realities surrounding the program's implementation. This is a point that has often been lost in the past. The philosophical integrity of many early efforts at individualization has often been compromised for the sake of operational expediency. As a result there was often considerable disparity between the intended program and the way it did, in fact, operate.

It is through the design and subsequent rigorous implementation of decision rules, that the original intent of system designers is realized in systems operation.

It is usually impossible, however, to implement a system in its full complexity from the very onset. It is often necessary to initiate complex systems in a series of successive steps. Thus, there may be instances when, during the early stages of system implementation, the intent of the system designers can be only partially realized. The point being made here is that, in such instances, the initial operational compromise must be recognized clearly as temporary. Care must be taken to insure that the temporary compromises are not frozen into the system, and that they are rectified at the earliest possible moment.

If the ultimate goal of the program is to develop individualized educational programs which more nearly meet the particular needs of individual students, and render the proffered educational experiences more relevant to the particular needs of students, then the decision rules whereby those individual educational programs are specified lie at the very heart of the program. To this end, the instructional system exists only to accommodate the recommendations specified by the decision rules.

It would be naive, of course, to assert that the instructional system has to be developed so as to accommodate any possible set of recommendations developed by some particular algorithm. Clearly there are a large number of very real and very potent reality constraints. The algorithm developed for the generation of suggested individual educational programs cannot be created without keeping sensitive to the necessary limitations that must be imposed upon the instructional system by virtue of time, staff, and financial constraints. It is essential, however, that very careful effort be made by program administrators not to let the obverse happen.

Because of the greatly disproportionate investment of time, money, and effort into the creation of the instructional system, as contrasted to the creation of individualization procedures, there is a tendency for system development to generate an independent momentum of its own. As a result, program planning runs the risk of degenerating to simply attempting to capitalize upon what is available in the system rather than forcing the creation of the best educational program possible within the limits of the available resources. In other words, because of the great momentum generated by the sheer level of effort of instructional system development, there is a tendency for that development to continue along the lines deriving from past system efforts rather than along the lines defined as necessary and essential for maximizing, and optimizing, potential individualization for the student. This is a problem not limited simply to the development of educational systems. It is a generic problem characteristic of any large developmental operation. That component which, by virtue of its size, requires the bulk of attention tends to establish the direction of future development, and that direction tends to be a direction which is most convenient for the bulk of the developmental effort.

Superficially, this section may sound like a recommendation that the tail be permitted to wag the dog. One must look below the shallowness of such metaphors, though, and realize the individual program planning component of an individualized educational program is not simply some nonessential appendage to the instructional system but, rather, the very raison d'etre of the total effort.

To function in this latter capacity there obviously must be extensive information interchange dating from the earliest efforts at system development. Some of the types of information that will be essential to know for the generation of decision rules which are realistic vis-a-vis the resources, capabilities, and the developmental timelines of the instructional system are summarized in the following outline.

Areas of Requisite Information

I. General System Information
    A. What is the unit of management in
        1. Experience trail planning (the objective?)
        2. Instruction (the module?)
        3. Assessment (the objective or module, or are these identical?)
            a. Do tests relate to activities and territories as well as objectives? i.e., Separate tests for each activity? in each context?
            b. Are there summary tests, i.e., periodic achievement tests? If so,

c. What happens if student fails the summary test? - Compulsory review even if they passed module test originally?

d. What happens if they fail the module test? Keep taking it? Are there alternate forms?

e. Can a student challenge a module test?

f. If he passes a module test for one activity-context setting, does this imply he can pass it for all contexts?

g. What types of tests - teacher endorsements, performance evaluations, job performance evaluation, critical incidents, anecdotes, etc. are to be used? How are they to be scored?

h. Are there to be translation rules i.e., equation rules for equating EBCE record to public school equivalency and vice versa, and for equaling different test results within the system?

B. What provision has been made for system override?

1. What provisions are there for systems trouble shooting and monitoring?

2. What provision for input to the student ombudsman/coordinator are there?

3. What sanctions can be applied, and who has the authority to apply them in the event of systems default to the detriment of the student?

C. Will modules yield career relevant performance skills as well as academic mastery skills?

D. How is the module descriptor information to be made available?

1. Module qua module

2. Module qua curriculum

3. Module qua individual

4. Module qua system

E. What provision for non-modular instruction will there be? - How extensive? - How managed?

F. What are the precedence rules for resolution of conflict and/or resultant ordering of priorities derived from above?

G. What provision for non-modularized instruction -- and/or modularized independent study will therebe? - How will this be coded and managed?

II. Information System Information

A. What data are to be kept, and in what form?

1. Student I.D.
2. Old student I.D., if any
3. Age, sex
4. Interest, ability, value data - in what form, how equated?
5. Student ability profile re. various LRG's
6. Student academic history from public school
7. Student academic history from EBCE
8. Student work experience history
9. Student-Parent input data for ET planning
10. Anecdotal/critical incident records
11. Student operation data e.g., time per module - changes in goals, etc.

B. How are the data to be collected?

1. Entry tests
2. Real time
3. Periodic inputs
4. Direct submission (mark sense cards by subject)
5. Mediated via counselor-teacher

C. What are the procedures for data file updating?

1. If there is a system-discovered conflict
2. If student wishes to update
3. If there is a system error discovered
4. How often will it be permissible
5. How often will routine updating take place

D. Will equating procedures be available? Before storage or on retrieval?

E. Learner characteristics

1. What is the domain of individual characteristics to be considered in the learner diagnosis system?
2. How is the learner diagnosis to take place? Who is to do it? How frequently is it to be updated? In what form and on what time table is it to be available? Does this include academic history as well? What is the timeline decision of academic history from current module performance record? Will this include career relevant skills assessment as well as academic skills assessment? What about social/behavioral assessment? Will the instructional system have social behavior modules as well as academic mastery and career relevant performance skills?

F. How are the data in the files to be guarded?

   1. Will all data in files be open to the student? If so, how will "confidential" information be treated?
   2. If confidential, who is the release authority? What guidelines will there be?

G. How are the data in the files to be retrieved?

   1. Online/Real time
   2. Same day
   3. Periodic batch
   4. What is the form for request
   5. Does data retrieval require chain of command approval
   6. How often can an individual request data
   7. How fast will the turn-around time be? Will priority turn around be possible?
   8. How will the data be made available? What about its confidentiality?

H. Monitoring - flagging

   1. Will there be crisis threshold monitoring (i.e., flagging) re:
      a. Student behavior - of various types
      b. Student module progress
      c. Student performance characteristics re: progress
      d. Flagging upcoming requirements for instructor activity
      e. Flagging upcoming counselor activities
      f. Employer critical incidents flagging
      g. Module critical incidents flagging (for formative evaluation)
      h. Flagging module consumption and materials utilization for better supply and logistics
      i. Flagging other systems breakdowns - e.g., decreasing individualization in ET at particular centers
      j. Flagging staff performance - for management decisions
   2. Will there be suspense monitoring on overdue transactions?
   3. Will there be "tickler" or advisory-reminder monitoring?

III. Instructional Materials Information (assuming objectives, activities, and territories are independent)

A. Objectives

   1. Domain relevance
      a. Domain assignment (may be multiple)
      b. Salience or centrality

2. Career relevance
    a. Relevant to career entry (often simply an academic requirement)
    b. Relevant to task performance
3. Sequence specification
    a. To maximize learning
        (1) Learning hierarchy
        (2) Task prerequisite hierarchy
    b. To maintain logical sequence (for entry-exit purposes)
    c. To allow cross "course" and cross domain integration
    d. Sequence violation sanctions and remediation procedures
4. Relevance to appropriate student characteristics, i.e., interests, values, abilities

B. Activities
1. Level of difficulty - reading, quantitative, interest, etc.
2. Relevance to objectives above
3. Relevance to appropriate student characteristics
4. Relevance to system supply and logistics constraints
5. Relevance to time constraints
6. Relevance to socio-political-legal constraints
7. Length of time required for satisfactory completion

C. Territories - Contents
1. Relevance to objectives above
2. Relevance to activities above
3. Relevance to appropriate student characteristics
4. Relevance to reality constraints of: availability of transportation, time in transit, associated expenses, socio-political-legal constraints

IV. Student-Parent Information

A. Goals

1.	Student-Parent aspirations	by each of the four FWL-EBCE domains
2.	Student-Parent analyzed LRG's	by each of the four FWL-EBCE domains
3.	Short term objectives	by each domain and sub-domain
4.	Current level of achievement	in each domain, sub-domain, cluster, module, activity

B. Interests, Values, Abilities
   1. Interests across all domains, sub-domains, and activities
   2. Values across all domains, sub-domains, and activities
   3. Abilities across domain, sub-domain, and activity
   4. Personal commitments across domain, sub-domain, and activity

C. Personal Operating Styles
   1. Learning style (optimum modality utilization)
   2. Self-management skills
   3. Persistence, motivation, task maintenance skills
   4. Interpersonal/situational operating characteristics
      a. Initiating versus responding styles by type of situation
      b. Habitual (typical) performance versus capability (potential)

D. Precedence Rules (to resolve conflicts arising from non-compatible input from various areas above)

Development of Procedures for Decision Rule Implementation

Assuming that decision algorithms have been specified which are generally consonant with the capabilities of the instructional system, the next step is to specify the procedures whereby those rules can be implemented. This is, of course, not strictly a sequential matter. The decision rules themselves can only be developed adequately if attention is paid, concurrently, to the way in which they will be implemented. Thus, the development of the rules and the procedures for the implementation of those rules must proceed concurrently. Unfortunately, these two activities can only be discussed successively, however.

There are three basic paradigms for the implementation of individual program planning rules. They may be implemented: 1) by humans working independently; 2) by machines, such as computers, working independently (i.e., without human mediation); or 3) by humans supported by machine service. Machine service may range from simple data retrieval devices, to data analysis and recommendation systems, to complete machine suggestions which may be accepted or rejected by humans. Of course, various combinations of these may be employed.

Program planning by individuals, usually by academic advisors, or by the learner himself, is, of course, the oldest procedure for the individualization of educational programs. It is the paradigm employed in most high schools and universities today; it is the basis for the planning of doctoral level studies; and it is also the basis for the individualization of instruction in Individually Prescribed Instruction. (See Chapter 3).

Typically only minimal instructions are given to the educational planner and a great deal of reliance is placed on his professional judgment.

Completely computerized educational planning has been used in only the narrowest of contexts. Machine generated programs are found typically in programmed instruction. They typically project plans no more than a few days, or weeks, into the future, and then only within the confines of the particular subject being studied.

The state of the art in the early 1970's is such as to suggest the intermediate approach of technologically assisted human decision making. This intermediate approach is the one used by Project PLAN for public school-age students and by Oakland Community College for college-level students. Both of these programs were described briefly in Chapter 3. At this point, it will be useful to describe those two programs more fully in order that they might serve as exemplars.

Prototype Individual Planning Procedures

PLAN. It is through personalized programs of studies that PLAN individualizes a student's education. The program individualizes content and instructional method as well as quota and length of exposure time.[1]

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[1] Material in this section is drawn from Dunn, J. A., "Career Education and Guidance in the PLAN System of Individualized Education" in Career Education and the Technology of Career Development, by D. V. Tiedeman (editor), Palo Alto: AIR, in press.

In particular, the following are considered in the individualization of a student's study program:

1. What the student needs to know;
2. What the student already knows;
3. What the student would like to know;
4. The rate at which the selected content should be presented;
5. The sequence in which the content should be presented;
6. The mode of presentation of that content;
7. The difficulty level of the learning materials used to teach the content;
8. The nature of the physical and social context in which the teaching/learning takes place;
9. The amount of teacher supervision, media-richness, and technology involved;
10. Student-parent long-range goals and aspirations; and
11. The student's level of developed abilities.

(The various sources of input to the PLAN student's program were graphically summarized in Chapter 3 (Figure 3-2, page 37.)

A student's Recommended Program of Studies (POS) is produced as follows: first, information as to the student's long-range goal aspirations is retrieved. This information is the output of the Goal Formulation Program previously described.

Next, data with regard to the student's interests, achievement levels, and developed abilities are obtained from the Expressed Interests Inventory, the PLAN Achievement and the Developed Abilities Performance Tests. From information about the student's developed abilities, a second long-range vocational goal was generated for the student, using TALENT based regression equations. This "data-suggested" LRG is used to supplement the parent-student planning so as to have an alternative option open for the student. The student's two long-range goal (LRG) categories plus his expressed interests then play the major role in determining what content will be recommended for him.

Next, information regarding any special state or local school system requirements is retrieved. At this point the computer is ready to search out those modules considered most important for the student to take. To do this the computer must search among 70,000 module descriptor codes in its decision making process.

The Individualization of Content--Module Selection. Given information about a student's long-range goals, his expressed interests, citizenship requirements, and state and local school requirements, the computer generates a list of recommended modules arranged in the following order: 1) state requirements; 2) local requirements; 3) essential citizenship requirements; 4) parent-student long-range goal requirements; 5) parent-student long-range goal highly desirable modules; 6) computer recommended LRG requirements; and 7) computer recommended LRG highly desired experiences. Depending on the student's LRG pattern, this list may represent from 3 to 5 years' worth of work.

The student's past history is then searched to see what he has already mastered and to see if he has the necessary academic foundation to pursue the work that will be expected of him in the coming year. Next, the student's achievement test results are considered to see if there is anything from last year's material that needs to be reviewed and what, if anything, from the coming year's work he may already know. These procedures define what might be described as the core content of the student's future POS.

These core requirements are then projected across the time remaining for the student to study that particular area. If the student's POS called for less than 3 years of mathematics, the length of time allotted to mathematics would depend on his past performance rate in mathematics, unless there was a scheduling limit placed on the planning by the student. If on the other hand, his POS called for more study than time permitted, if, say, it recommended 4 years of mathematics as desirable for the student, given his LRG pattern, and there were only 3 years remaining, the POS would design a "heavy load" program for the student, explain why it was so heavy, and advise him that if he wishes to pursue his LRG to his best advantage, he should either a) revise upward the total number of years he expects to spend studying in that area; or if that is impossible, b) increase the amount of time and effort he will devote to the study of that subject in the time he has left.

Figure 7-1 gives several examples of POS messages.

FIGURE 7-1

Sample POS Messages

Take Placement Test 91-052. On the basis of the results of this test you will be placed into either the Sullivan, Miami, or Chandler Reading Programs, or into Placement Test 91-053 with subsequent assignment into the Harper-Row Reading Program.

Take all the modules in any ________ of the following ________ groups. Once you begin work on a module in one group, complete all modules in that group before going on to another group.

After completing the following group of modules, take PLAN Achievement Test_____.

There are two approaches to the study of World History available in PLAN. You may study from selected themes of history or you may study from a chronological approach. Chose one of the following two sets of modules. Set 48-017 structures history thematically. Set 48-018 structures it chronologically.

When you complete this module you will have completed your basic mathematics program. If you wish to go further in mathematics, please consult your teacher about developing your abilities further in geometry. This may be done either by taking modules dealing with areas, similarity and circles (modules 23-649 through 23-654 in the sequence which you have been studying) or by taking modules 20-543 and 20-548 through 20-551 which deal with constructions, indirect measurement, and trigonometry. The latter set of modules does not require proofs of theorems.

If you find some advanced algebra modules listed after the basic trigonometry modules, please take them in that order. These advanced algebra modules are as important as the trigonometry modules for the achievement of your long-range goal.

Modules 26-870 and 26-884 do not deal with calculus. However, they cover topics that appear on the CEEB Advanced Placement Examination in Mathematics. Module 26-870 is particularly important as a prerequisite to the study of calculus.

Your test results suggest that you know some of the objectives of these modules in your program of studies. After reviewing each module carefully, consider challenging it.

Your test results show that you should review the objectives of these modules which you completed last year. Do not submit status or test cards for them.

You should have the equivalent of four years of high school science for the new LRG you have selected. You have already completed the equivalent of one year. Your science POS this year and next will suggest a heavier than normal load in order for you to complete your science requirement in the two years you still have left before graduation. You may wish to discuss this problem with your counselor and/or social studies teacher to see about a corresponding reduction in your social studies POS.

After the basic or core requirements are identified and distributed across the balance of the time expected to be devoted to the study of that content, attention is then turned to determining how much of the requisite material should be taken in the immediately ensuing year. If n is the number of years remaining to study in an area, then the student is assigned at least 1/n of the required modules. Typically the core requirements constitute much less than a year's worth of study, so attention must shift to the assignment of modules to augment these basic core modules. To do this, consideration must be given to determining what is a reasonable amount of work for the student to cover in a year.

This is determined by taking into consideration both the student's level of developed abilities, as determined by a battery of tests administered in the spring, and also the number of modules the student completed the preceding year.

In the event that a student's quota is not filled by the 1/n requirement (an almost guaranteed condition), the POS then begins to assign lessons that are considered highly desirable for the student to take. These are lessons not considered to be absolutely essential for further academic progress but which are nevertheless considered to be very important basic content for the student to learn.

If upon completion of assignment of these highly desirable lessons the student's quota for the year is still not filled, the remainder of the quota is divided evenly between lessons expected to appeal to the special interests of the student and required modules from the next higher level. Assignment of modules of this latter type permits some measure of student acceleration without sacrificing curriculum enrichment.

After module selection and quota determination, attention is then directed to module sequencing. Many modules are, of course, sequenced by the logical development of the content. Mathematics is a good case in point; but even in mathematics, there are units of material which need not follow a rigid sequence within the year. Indeed, in the areas of Social Studies and Literature a great deal may be studied sequence free. All modules in the system are coded as to their sequence characteristics; and indeed, some modules are coded to be collaterally sequenced across subject matter areas. The correlation of the study of the metric system in mathematics and measurement in science is an example.

Individualization of Method--TLU Selection. At this point, specific TLU assignment takes place. Up to now the only consideration has been identification of the content to be studied, i.e., which lessons, how many lessons, and in what sequence the lessons should be taken. Now we are faced with the question of learning style, i.e., what particular TLU's the student should take to study the assigned lessons so as to maximize the likelihood of his mastering the content as quickly as possible. It is at this point that the computer matches the student with specific TLU's.

The results of these computer-generated decisions are then printed as a formal Program of Study for the student. It is printed in two copies, one for school record keeping, and the other for teacher-student classroom use. Three sample POS's were given in Chapter 3 (Figures 3-4, 3-5, and 3-6, pages 42-44).

Each teaching-learning unit was coded as to its reading difficulty, the degree to which it required teacher supervision, its media richness characteristic, the degree to which it required social involvement and/or group learning activities, the amount of reading involved, and the variety of activities inherent in the unit. Related data regarding the student is obtained from data inputs from the teacher and student test results.

The POS module assignment and TLU matching rules are not best-fit rules, however, since one wants a student's program to stretch the student a little, to broaden his interests and strain his intellectual ability a little, and lead him a little further down the educational road than he might ordinarily go. Best fit is called for in only an arbitrary percentage of the time, e.g., ninety percent. One of the big unanswered questions is what this value should be. From need-achievement/fear of failure research, and other motivation research, it would seem this should be variable for different individuals. And in time, given experience with POS operation, I am sure this will be individualized as well as any of the other factors.

POS Modifiability. The student can add or delete modules to the POS with considerable ease; and if he chooses, even totally revise the recommended Program of Studies. A formal change in the POS can be made by simply indicating the number of the module he would like to delete or add. Barring this, he can even effect a change in the POS by simply studying a module or TLU not on his POS. Then, when the student's test card is filed with the computer, the computer notes that the module or TLU is different from any on the student's recommended POS and asks the student to verify that a coding mistake on the test card has not been made, i.e., that the new selection is in fact a deliberate selection. Upon confirmation, the computer adds the new selection to the student's Program of Studies file automatically and from that point forward it is carried in his record.

As one would expect, PLAN POS's will vary considerably in type and amount of content covered, and in the rate and sequence in which that content is covered.

Finally, with regard to some simple operating characteristics, student programs of study are not easily generated by hand. They are run on an IBM 360 Model 50 computer. The specification of decision rules for POS generation required 200 pages of directions and flow charts plus 200 more pages of other tables and test score cut points. This is in addition to the 70,000 module descriptor codes necessary to organize, classify, and sequence the instructional materials available in PLAN.

Over 140,000 units of core storage are required to store curriculum information about the modules in the PLAN system. The remaining 8,000 units of storage are required for processing. The processing time for each secondary student's POS (one in each of four subject matter areas: mathematics, science, language arts, and social studies) is approximately 40 seconds. While this seems like a very brief time, and indeed is very economical considering the size of the task, 40 seconds of continuous computer processing on a machine such as the IBM 360-50 represents an extremely large number of decisions for each student.

The Oakland Community College Personalized Educational Program. The Oakland Community College Personalized Educational Program is predicated on a series of diagnostic tests and clinical interviews which yield a "map" of students' cognitive styles. These maps are then used for educational program planning. Data analysis and the generation of cognitive maps is a computer activity. The actual generation of personalized educational programs, however, is the result of interaction of the student with course instructors and counselors.

Upon admission to the college, and subsequently when warranted, the student undergoes a half-day battery of psychological tests plus a series of clinical interviews. Some tests measure student ability to handle complex abstractions, some measure manual coordination, some measure sensory modality preference, some measure personal characteristics, and so forth. These results are analyzed by computer and a "cognitive style map" is generated.

A student's cognitive style is defined as "the way he takes notice of his total surroundings -- how he seeks meaning -- how he becomes informed." For example: "Is he a listener or a leader? Is he concerned only with his point of view or is he influenced in decision making by his family or by his group associates? Does he reason more like a mathematician or social scientist or fisherman? . . . The particular way that each of us sees our world and responds to it is our cognitive style. . . . The cognitive style map gives a picture of the way a student derives meaning from his environment and personal experience. Each map, like each student, is different." (Hill and Nunney, 1971, page 7)

In describing the system Hill and Nunney (1971) have described Personalized Educational Program development as follows: "We first find out how the student uses symbols to solve problems -- how he uses his senses and inference properties when faced with a situation which has no existing meaning for him. How he searches for meaning in his environment. Whether he prefers: to listen or read; to see things only as they affect him or as his family or associates would see them; to categorize or to contrast or relate information. These diagnostic test data are used to produce a cognitive map for each student.

Next we develop a personal educational prescription for the student designed to guarantee him success in the course. . . . By using a unitized approach to course work and unit tests, we are able to assess whether a student has mastered the content of the unit before he moves on to the next unit. Constant feedback to the student and teacher from the prescription centers leads to modification of the personal prescription. . . . The overall aim is to guarantee the student a 90% success level of performance." (page 3)

The Oakland Community College program has direct relevance for Career Education, inasmuch as the college focuses heavily on vocationally relevant educational programs. The main thrust of the college is in the area of applied sciences and arts which include seven prime job cluster groups: business sciences, computer sciences, engineering technology, health sciences, home and personal services, industrial sciences, and public service sciences. Within each of these departmental or applied science areas, a number of vocational training programs are offered. For example: legal secretarial and real estate sales under business sciences; computer sales engineering and software programming under computer sciences; automotive technology and drafting technology under engineering technology; dental assistance and laboratory technology under health sciences; hotel-motel management and food service management under home and personal services; industrial carpentry, millwrighting, and industrial electrician service under industrial sciences; and landscape technology and law enforcement technology under public service sciences.

The Oakland Community College is well above average both in terms of size and in terms of the degree of practical application exerted in the curriculum. The college, for example, has approximately 15,000 students and offers almost 400 course titles. It is housed on three separate academic campuses and, in addition, operates in 25 different extension centers. The program is not all geared to high technology training either. Courses for nurses aides, teacher aides, and other Career Opportunity Programs are offered.

The identification of a personal cognitive style is, of course, only the first step in the production of a valid individualized educational experience for the student. Once the student's cognitive style has been "mapped" it is then the responsibility of the student and a team of teachers and counselors to generate a prescriptive educational program for the student in each of the courses for which he is registered. As would be expected, considerable variation must be offered in order to effect truly individualized programs. The individualization of course content is determined in large measure by course selection and this is dictated in turn largely by vocational options selected by the student. Within particular courses, however, prime attention is directed toward the individualization of the method by which the student is taught. There are seven different modes of instruction (i.e., instructional options). The student may learn his content through the use of: 1) programmed text material, 2) videotape-audiotape-filmstrip-multimedia presentations, 3) peer group tutoring programs, 4) library book-microfilm-independent reading programs, 5) formal faculty led seminars, 6) informal faculty/student rap sessions, and 7) independent study.

Upon completion of a unit of study, the student then takes a module test before he moves on to the next unit of study. If results of the module test suggests that one particular approach to learning, or a particular combination of approaches to learning is not resulting in student mastery, alternative instructional methods may then be recommended.

Test scoring, student cognitive style mapping, and student matching to presentation style is supported by a computer system management program. The instructors, and the staff of the prescription centers, however, are responsible for the actual implementation of computer recommendations.

The set of figures on the following three pages will serve to further elaborate on the system.

Limitations in the Planning of EBCE Programs

There are, of course, an extremely large number of factors which could operate to limit particular configurations of EBCE programs. At least eight should be singled out for brief comment.

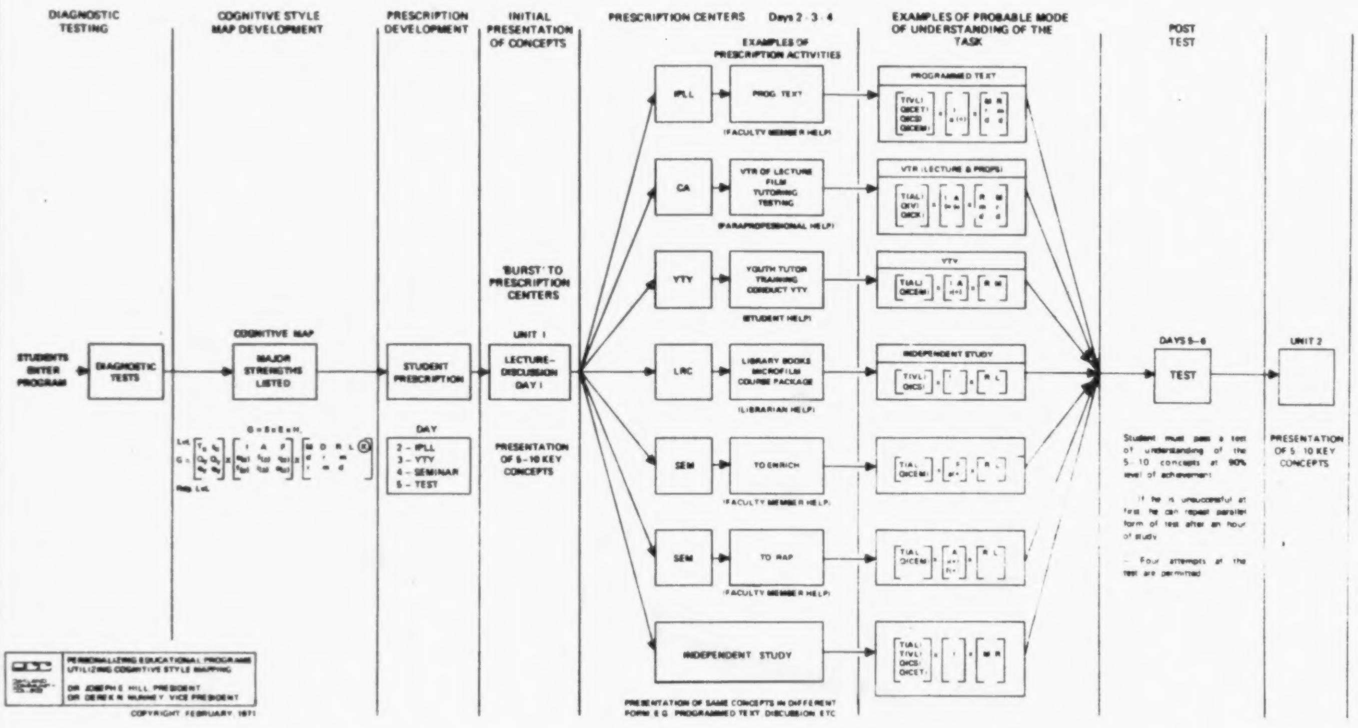
The first limitation to consider in the development of an EBCE program is, of course, cost -- cost to create a system and cost to operate the system once it is created. The creation of instructional systems are multi-million dollar efforts. A good many tens of millions of dollars have been devoted to the development of new curricula. Modern mathematics is a case in point but the delivery systems, such as IPI, IGE, and PLAN, cost several millions more.

In addition to cost, there are manpower/decision processing limitations. Even given adequate funding, the problem of assembling sufficient manpower to create the EBCE program and the coordination of the decision making within the assembled manpower can impose very decided limitations on potential operators of EBCE.

Third, there are gaps in the state of the art, not only in the academic content necessary to operate a comprehensive EBCE program but also in the availability of the hardware necessary to conduct such a program effectively. Equipment developed for commercial service operations often is not rugged enough to service educational applications.

FIGURE 7-2

Flow Chart of Personalized Educational Program (PEP) Illustrating Student Progress From Diagnostic Testing Through Successful Completion of an Instructional Unit.


DIAGNOSTIC TESTING
COGNITIVE STYLE MAP DEVELOPMENT
PRESCRIPTION DEVELOPMENT
INITIAL PRESENTATION OF CONCEPTS
PRESCRIPTION CENTERS Days 2 - 3 - 4
EXAMPLES OF PROBABLE MODE OF UNDERSTANDING OF THE TASK
POST TEST
STUDENTS ENTER PROGRAM
DIAGNOSTIC TESTS
COGNITIVE MAP
MAJOR STRENGTHS LISTED
STUDENT PRESCRIPTION
DAY
2 – IPLL
3 – YTY
4 – SEMINAR
5 – TEST
'BURST' TO PRESCRIPTION CENTERS
UNIT I
LECTURE-DISCUSSION DAY I
PRESENTATION OF 5–10 KEY CONCEPTS
EXAMPLES OF PRESCRIPTION ACTIVITIES
IPLL
PROG. TEXT
(FACULTY MEMBER HELP)
CA
VTR OF LECTURE
FILM
TUTORING
TESTING
(PARAPROFESSIONAL HELP)
YTY
YOUTH TUTOR TRAINING
CONDUCT YTY
(STUDENT HELP)
LRC
LIBRARY BOOKS
MICROFILM
COURSE PACKAGE
(LIBRARIAN HELP)
SEM
TO ENRICH
(FACULTY MEMBER HELP)
SEM
TO RAP
(FACULTY MEMBER HELP)
INDEPENDENT STUDY
PRESENTATION OF SAME CONCEPTS IN DIFFERENT FORM E.G. PROGRAMMED TEXT DISCUSSION ETC
PROGRAMMED TEXT
VTR (LECTURE & PROPS)
YTY
INDEPENDENT STUDY
DAYS 5–6
TEST
UNIT 2
PRESENTATION OF 5–10 KEY CONCEPTS
PERSONALIZING EDUCATIONAL PROGRAMS UTILIZING COGNITIVE STYLE MAPPING
DR JOSEPH E. HILL PRESIDENT
DR DEREK N. NUNNEY VICE PRESIDENT
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Student must pass a test of understanding of the 5–10 concepts at 90% level of achievement.

If he is unsuccessful at first, he can repeat parallel form of test after an hour of study.

— Four attempts at the test are permitted.

CAMPI/PEP
Computer Assisted Management of Personalized Instruction

The Mode of Understanding of the educational task is used by the computer to design the modes of presentation associated with the Prescription Centers. The computer is then used to match the cognitive style of the student with that mode of presentation found to be "best" for him. After matching, CAMPI administers an entry level test, scores it, reports results to the instructor, to the prescription center, and to the student. CAMPI also administers final tests on units, scores them, reports results to the instructors, the prescription centers, and the students. CAMPI is also capable of analyzing test scores to the point of identifying concepts included in a study unit that:

(a) the student has mastered,

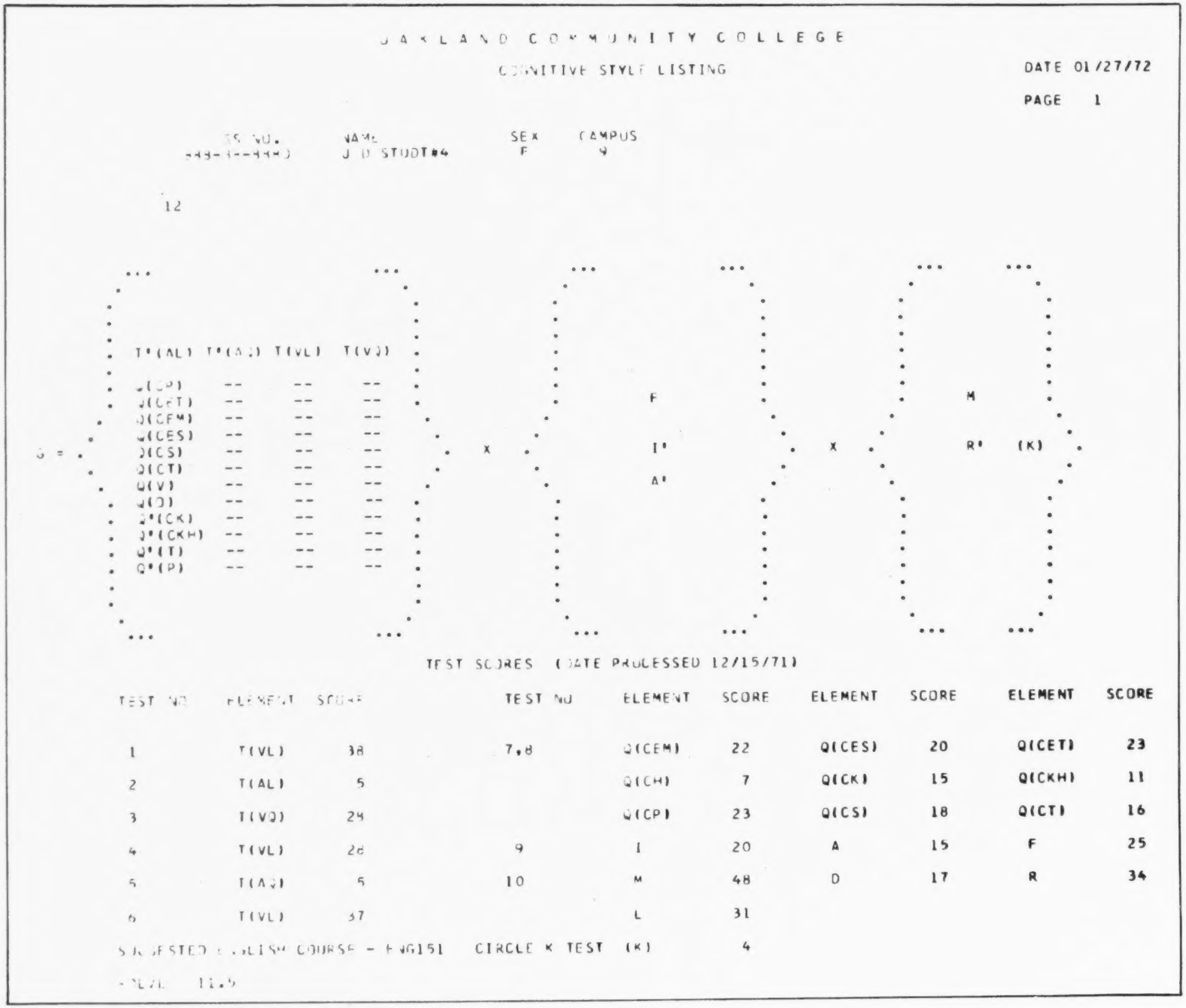
(b) the student has not mastered,

(c) of those he has not mastered, the ones he should complete most easily, and

(d) of those not completed, the ones that will probably be most difficult for him to accomplish.

FIGURE 7-3

Sample Computer-Generated Cognitive Map



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                        OAKLAND COMMUNITY COLLEGE
                         COGNITIVE STYLE LISTING                DATE 01/27/72
                                                                PAGE   1
         SS NO.            NAME          SEX   CAMPUS
       [illegible]         J D STUDT#4    F      9

    12

       T'(AL) T'(AQ) T(VL)  T(VQ)

       Q(CP)    --     --     --
       Q(CET)   --     --     --             F                  M
       Q(CEM)   --     --     --
       Q(CES)   --     --     --
 G =   Q(CS)    --     --     --     X       I'        X        R'   (K)
       Q(CT)    --     --     --
       Q(V)     --     --     --             A'
       Q(D)     --     --     --
       Q'(CK)   --     --     --
       Q'(CKH)  --     --     --
       Q'(T)    --     --     --
       Q'(P)    --     --     --

                         TEST SCORES  (DATE PROCESSED 12/15/71)
TEST NO    ELEMENT   SCORE        TEST NO    ELEMENT   SCORE   ELEMENT   SCORE   ELEMENT   SCORE

 1          T(VL)     38           7,8       Q(CEM)     22     Q(CES)     20     Q(CET)     23
 2          T(AL)      5                     Q(CH)       7     Q(CK)      15     Q(CKH)     11
 3          T(VQ)     28                     Q(CP)      23     Q(CS)      18     Q(CT)      16
 4          T(VL)     28            9        I          20     A          15     F          25
 5          T(AQ)      5           10        M          48     D          17     R          34
 6          T(VL)     37                     L          31
SUGGESTED ENGLISH COURSE - ENG151   CIRCLE K TEST  (K)       4
LEVEL   11.5
```

FIGURE 7-4

A BRIEF GUIDE TO COGNITIVE STYLE MAPPING

Symbols and Their Meanings

Two types of symbols, theoretical (e.g., words and numbers) and qualitative (e.g., code data) are basic to the acquisition of knowledge and meaning. Theoretical symbols differ from qualitative symbols in that the theoretical symbols present to the awareness of the individual something different from that which the symbols are. Words and numbers are examples of theoretical symbols. Qualitative symbols are those symbols which present and then represent to the awareness of the individual that which the symbol is. (Feelings, commitments and values are some examples of the meanings conveyed by the qualitative symbols.)

There are four Theoretical Symbols:

1. T(AL)—**Theoretical Auditory Linguistic**—the sound of a word
2. T(AQ)—**Theoretical Auditory Quantitative**—the sound of a number
3. T(VL)—**Theoretical Visual Linguistic**—the written word
4. T(VQ)—**Theoretical Visual Quantitative**—a written number

The meaning of qualitative symbols is derived from three sources: sensory stimuli, cultural codes (games), and programmatic effects of objects. There are 15 qualitative symbols. Five of them are associated with sensory stimuli:

1. Q(A)—**auditory**—the ability to perceive meaning through the sense of hearing.
2. Q(O)—**olfactory**—the ability to perceive meaning through the sense of smell.
3. Q(S)—**savory**—the ability to perceive meaning by the sense of taste.
4. Q(T)—**tactile**—the ability to perceive meaning by the sense of touch.
5. Q(V)—**visual**—the ability to perceive meaning by the sense of sight.
6. Q(P)—**proprioceptive**—sometimes referred to as the sixth sense—vehicle for conveying meanings associated with "programmatic effects";
7. Q(CEM)—**code-empathetic**—the ability to identify with, or have a vicarious experience of, another person's feelings, ideas or volitions;
8. Q(CES)—**code-esthetic**—the ability of the individual under consideration to view with enjoyment the "beauty" and "pureness" of a resulting product, situation or idea;
9. Q(CET)—**code-ethic**—a commitment to a set of values, a group of moral principles, obligations, and/or duties;
10. Q(CH)—**code-histrionic**—staged behavior, or a deliberate exhibition of emotion or temperament to produce some particular effect on other persons.
11. Q(CK)—**code-kinesics**—the ability to communicate by means of non-linguistic functions such as blushing and motions of the body, such as shrugs, smiles and gestures.
12. Q(CKH)—**code-kinesthetics**—motor skill abilities.
13. Q(CP)—**code-proxemics**—the ability of an individual to judge the acceptable critical physical and social distance between himself and others as perceived by the other person.
14. Q(CS)—**code-synnoetics**—personal knowledge of oneself in all qualitative and theoretical symbolic forms in relation to one's environment.
15. Q(CT)—**code-transactional**—the ability to maintain a positive communicative interaction which significantly influences the goals of the persons involved in that interaction.

Cultural Determinants

The meanings that man assigns to symbols, shape and are shaped by his culture. The main cultural influences, or "cultural determinants" of the meanings of symbols, are family, associates and individuals.

F—Family **I**—Individual **A**—Associates

Modalities of Inference

The forms of inference the individual uses in the process of deriving meaning.

M—Magnitude inference process is a form of "categorical thinking," and utilizes norms categorically classified, and attitudes accepted as true by the individual as the basis for acceptance or rejection of advanced hypotheses.

D—Difference deals with hypotheses of difference such as one-to-one contrasts or comparisons of selected characteristics or measurements.

R—Relationship process considers a relationship between two or more characteristics or measurements.

L—Appraisal type of inference considers, with equal weight, hypotheses of all the previous three (magnitude, difference and relationship) in arriving at a probable conclusion.

GLOSSARY OF TERMS

1. **CAMPI**
   Computer Assisted Management of Personalized Instruction. CAMPI is a specialized form of PEP.

2. **CA—Carrel Arcades**
   Carrel Arcades are large areas for relaxed individual study, small group discussions and tutorial sessions. A separate staff primarily composed of paraprofessionals working in a supportive role in the arcades help students seek meaning in their own way and at their own speed in activities designed by regular faculty members.

   The Carrel Arcades contain audio-visual resources and here students may review videotaped lectures, listen to audio-tapes, view films, or study course materials on other audio-visual equipment. Small groups meet for informal talk sessions with teachers and resource people.

3. **Cognitive Style Mapping**
   The cognitive style map gives a picture of the way a student derives meaning from his environment and personal experience. Each map, like each student, is different. A student's cognitive style is determined by the way he takes notice of his total surroundings—how he seeks meaning—how he becomes informed. Is he a a listener or a reader? Is he concerned only with his point of view or is he influenced in decision-making by his family or by his group associates? Does he reason more like a mathematician or social scientist or fisherman?

4. **Educational Prescriptions**
   Using this cognitive style map and subjective information gathered in private conversation with the student, a team of teachers and the student jointly develop a Personalized Education Program for the student which is geared to his strengths and weaknesses—a program which is his personal educational prescription and which promotes his success. A computer may be used to expedite the process.

5. **IPLL—Individualized Programmed Learning Laboratory**
   In the IPLL, students use programmed texts and other highly organized materials under supervision of faculty members especially trained in individualized education techniques. The student receives expert guidance to solve his specific problems. Many of these students prefer to work alone rather than in groups.

   He is given diagnostic tests when he first enters the laboratory. These tests are used in choosing the programs the student will work.

6. **LRC**
   The LRC includes the college library, but offers more than traditional library services. It is a clearinghouse for a large variety of instructional packages. In addition to the usual books and periodicals, the LRC collection includes microfilms, special displays and research materials in many forms.

7. **PEP—Personalized Educational Program**
   The situation in which the student's work will be chosen by the student and his instructor on the basis of the student's needs, ability and cognitive style. They will jointly develop an educational prescription. The student will remain responsible for the content of his courses but may "Burst" into any of several instructional modes available.

   At the heart of PEP is the classroom teacher or team of teachers. Scheduled classes remain an essential part of the educational approach, and teachers remain the student's principal point of reference.

   The flexible programming that makes success so available to students involves the careful balancing of professional skills, scientific methods and equipment.

8. **Performance Testing**
   Courses in the PEP curriculum are broken down into units of a few weeks. These units are actually mini-courses—each having well-defined goals.

   Students take tests to move from one unit to the next. They must succeed in each unit before moving on. Successful completion of each unit reinforces a student's positive view of himself and of the course materials.

   Constant interaction with faculty, paraprofessionals and tutors is designed to guarantee successful performance by the student. By analyzing [illegible] performance and modifying his prescription, the educational program of each student is humanized and personalized.

9. **Seminars**
   The student who comes alive in the dynamics of group interaction may participate in free and easy "rap" sessions with teachers and other students. Other students may prefer a seminar with a faculty member who presents more of a "fatherly" image and with whom they feel more comfortable and confident. The student who relates to teachers more easily on a one-to-one basis may work through conferences with his instructor.

10. **YTY—Youth-Tutor-Youth**
    YTY makes student help available to other students on a regular basis. Students who have already mastered course materials are trained by the professional staff to tutor other students. Because the youth tutors, themselves, may have experienced problems with course material, they often can spot trouble and show students approaches that might escape a faculty member.

Fourth, there are limitations in the construction of EBCE models which are imposed by the amount of data which must be kept, stored, routinely updated, and so forth. Fully individualized instructional programs require a great deal of information and a great deal of decision making. This, of course, must be predicated on the existence of accurate and rapidly available information regarding both the system options as well as the learners.

Fifth, there will be very real limitations imposed upon EBCE by the simple availability of appropriate curriculum and instructional materials. There may be many areas in EBCE where commercial materials may simply not be available to achieve the goals desired by EBCE programmers.

Sixth, there will be very real limitations imposed upon what EBCE can effectively accomplish due to students' peer-group and social-attitude limitations. There will be no effective way short of thorough analysis and appraisal of what student attitudes and values are vis-a-vis EBCE goals and the procedures and processes whereby EBCE will attempt to arrive at its goals.

Seventh, a very major problem to be encountered by EBCE will be the problem of student transiency. Presumably students will be able to transfer into and out of EBCE at any time. Transferring into EBCE will probably be a greater problem than transferring out, especially if EBCE is to conscientiously pursue its goal of individualizing education. There will be relatively little information on new students entering the EBCE program which can be used in the development of individualized educational program options for the student. There may be levels of sophistication of individualization which operate for students depending on the level of information available to them.

Finally, but not least important, EBCE cannot be creative without very serious attention given to the philosophical limitations that must be imposed on it by education, society, and the interests of the employers operating EBCE.

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